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2025

EBCNYS

EXISTING BUILDING CODE OF NEW YORK STATE®

Kathy Hochul Governor
Walter T. Mosley Secretary of State

NEW YORK STATE | Department of State
Building Standards & Codes

ICC INTERNATIONAL CODE COUNCIL®

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STATE FIRE PREVENTION AND BUILDING CODE COUNCIL

Walter Mosley	Chair - Secretary of State, New York State Department of State Designee - Matthew Tebo, Esq.
James Cable	State Fire Administrator, Office of Fire Prevention and Control Designee - Benjamin Keller
RuthAnne Visnauskas	Commissioner, Division of Housing and Community Renewal Designee - Kristy Whitcher Designee - Joseph Palozzola
Roberta Reardon	Commissioner, New York State Department of Labor Designee - Vincent Rapacciuolo Designee - John Kunac
Eric Adams	Mayor, City of New York Designee - Keith Wen, NYC Department of Buildings
Michael Spano	Mayor, City of Yonkers Designee - James Gibbons
Joseph DeStefano	Mayor, City of Middletown
Joseph Toomey	Fire Service Official
Shawn Hamlin, R.A.	Registered Architect Representative
Timothy DeRuyscher, P.E.	Professional Engineer Representative
Robert Hughes	Code Enforcement Representative, Village of Pleasantville
William Tuyn	Builders Representative
Patrick Dolan	Trade Union Representative, Steamfitters Union, 638
Dominic Marinelli	Persons with Disabilities Representative

PAST CHAIRS AND MEMBERS OF THE CODE COUNCIL

Robert Rodriguez	Previous Secretary of State
Michael Weber	Designee for RuthAnne Visnauskas (Division of Housing and Community Renewal)
Claudia Braymer	County Board of Supervisors, Warren County
Michael Sabatino	Designee for Michael Spano (City, Population Over 100,000)

DIVISION OF BUILDING STANDARDS AND CODES

Matthew Tebo, Esq.	Deputy Secretary of State
John Addario, P.E.	Division Director
Brian Tollisen, P.E.	Deputy Director

CODE DEVELOPMENT	
Kevin Duerr-Clark, P.E.	Assistant Director for Code Development
Larissa DeLango	Code Compliance Specialist II
Jeanne Rice, P.E.	Professional Engineer I
Chad Sievers, P.E.	Professional Engineer I
Stephen Van Hoose, R.A.	Architect I
Bryan Toepfer, R.A.	Consultant
ENERGY CODE SERVICES	
Emma Gonzalez-Laders, R.A.	Assistant Director for Energy Code Services
Gregory Benton	Assistant Engineer
Daniel Carroll	Code Compliance Specialist II
Christopher Jensen, P.E.	Professional Engineer I
Nicholas Petramale	Code Compliance Specialist I
Gina Joven	Consultant
TECHNICAL SUPPORT	
China Clarke, R.A.	Assistant Director for Technical Support
Bryant Arms	Code Compliance Specialist II
PROGRAM ATTORNEYS	
David Gonzalez, Esq.	Deputy Counsel
Panagiota Hyde, Esq.	Associate Attorney
Benjamin Kosinski, Esq.	Former Associate Counsel
Anna Binau, Esq.	Former Senior Attorney
Amalia Talty, Esq.	Assistant Attorney III
Shanice Helena	Administrative Assistant I
Natacha Carbajal-Evangelista	Former General Counsel

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PREFACE

ABOUT THE NYS CODES

In 1978, the State Legislature added Article 11 to the Energy Law to provide for a comprehensive energy conservation construction code applicable to all public and private buildings in New York State (including buildings located in the City of New York). Article 11, consisting of sections 11-101 through 11-110 of the Energy Law, sets forth the process by which the State Energy Conservation Construction Code ("Energy Code") is to be developed, maintained, administered, and enforced for the conservation of energy in buildings in New York State. Both State government and local governments are participants in this process.

In 1981, the New York State Legislature enacted legislation directing the development and implementation of an integrated, Statewide building and fire prevention code. Prior to the adoption of this legislation, the decision as to whether to adopt and enforce a building and/or fire prevention code was left to the discretion of local governments in New York State. Many municipalities, primarily in the more developed and densely populated areas of the State, had adopted building and/or fire prevention codes. However, there were also many communities, mostly rural in nature, where no building or fire prevention code was in effect.

In light of the perils posed by fire and inadequate building construction, the State Legislature adopted a new Article 18 of the Executive Law to provide for an integrated and comprehensive building and fire prevention code. Article 18, consisting of sections 370 through 383 of the Executive Law, sets forth the process by which the code is to be developed, maintained, administered, and enforced for the protection of all New Yorkers. Both State government and local governments are participants in this process. The code, called the New York State Uniform Fire Prevention and Building Code ("Uniform Code"), took effect January 1, 1984 and prescribed minimum standards for both fire prevention and building construction. It is applicable in every municipality of the State except the City of New York, which was permitted to retain its own code.

Although the Uniform Code took effect in 1984, its antecedents are much older. Beginning in the late 1940's, New York State began developing a code known as the State Building Construction Code, which provided standards for the construction of buildings and the installation of equipment therein. Developing and maintaining the State Building Construction Code eventually became the responsibility of the New York State Division of Housing and Community Renewal (DHCR). In the 1960's, DHCR began developing a second code, the State Building Conservation and Fire Prevention Code, to address fire safety practices in buildings. Both of these codes were applicable in a municipality only when affirmatively adopted by the governing body. The State Building Construction Code and the State Building Conservation and Fire Prevention Code were repealed effective January 1, 1984 when they were replaced by the Uniform Code.

Code Development Process

Responsibility for developing and maintaining the Uniform Code and the Energy Code is vested in the State Fire Prevention and Building Code Council (the "Code Council"), a seventeen-member body chaired by the Secretary of State and composed of the Secretary of State, the State Fire Administrator, and fifteen other members appointed by the Governor (seven with consent of the Senate). The Code Council is required to meet at least quarterly but additional meetings may be called by the chair or by petition of five members of the Code Council.

Periodically both the Uniform Code and the Energy Code require amendment. The Uniform Code and the Energy Code are implemented via regulations, and any amendment of either code must be adopted pursuant to the rule making process set forth in the State Administrative Procedure Act ("SAPA"). In most situations, that process includes publishing a notice of proposed rule making in the New York State Register, specifying a period during which the public may submit comments on the proposed amendment (which, unless a different time frame is specified in statute, shall be at least sixty days) holding at least one hearing at which the public may present input regarding the proposed amendment, reviewing and assessing the comments received, and publishing a notice of adoption in the New York State Register. Generally, any amendment of the Uniform Code will become effective 90 days after publication of the notice of adoption; however, the Code Council has the authority to designate an earlier effective date if necessary to protect health, safety and security. An amendment of the Energy Code can be effective as early as the date of publication of the notice of adoption. However, when both the Uniform Code and Energy Code are amended at the same time, the effective dates are typically coordinated with each other. In addition, either code can be amended by adoption of an emergency rule, which can be effective as early as the date of filing of the notice of emergency adoption. New York's emergency rule making process allows an agency to adopt a rule on a temporary basis for a maximum of 90 days, at which time the emergency may be re-adopted, but each such re-adoption will be effective for a maximum of 60 days and to file for re-adoption the agency must also take action to initiate the proposal process to formally adopt the rule on a permanent basis. All rule-making activity is published on the website of the Division of Building Standards and Codes.

Coordination of the NYS Codes

The coordination of technical provisions allows the NYS Codes to be used as a complete set of complementary documents. Individual codes can also be used in subsets or as stand-alone documents. Some technical provisions that are relevant to more than one subject area are duplicated in multiple code books.

INTRODUCTION TO THE *EXISTING BUILDING CODE OF NEW YORK STATE*

The Existing Building Code of New York State (EBCNYS) establishes minimum requirements for existing buildings using prescriptive and performance-related provisions. It is founded on broad-based principles intended to encourage the use and reuse of existing

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buildings while requiring reasonable upgrades and improvements. This 2025 edition was developed as a derivative work of the 2024edition of the International Existing Building Code® (IEBC®) published by the International Code Council® (ICC®).

This code is founded on principles intended to encourage the use and reuse of existing buildings that adequately protect public health, safety and welfare; provisions that do not unnecessarily increase construction costs; provisions that do not restrict the use of new materials, products or methods of construction; and provisions that do not give preferential treatment to particular types or classes of materials, products or methods of construction.

The *Existing Building Code of New York State* is intended to provide requirements for repair and alternative approaches for alterations, changes of occupancy and additions to existing buildings. A large number of existing buildings and structures do not comply with the current building code requirements for new construction. Although many of these buildings are potentially salvageable, rehabilitation is often cost-prohibitive because compliance with all the requirements for new construction could require extensive changes that go well beyond the value of the building or the original scope of the alteration. At the same time, it is necessary to regulate construction in existing buildings that undergo additions, alterations, extensive repairs or change of occupancy. Such activity represents an opportunity to ensure that new construction complies with the current building codes and that existing conditions are maintained, at a minimum, to their current level of compliance or are improved as required to meet basic safety levels. To accomplish this objective, and to make the alteration process easier, this code allows for options for controlled departure from full compliance with the Uniform Codedealing with new construction, while maintaining basic levels for fire safety, structural and life safety features of the rehabilitated building.

This code provides three main options for a designer in dealing with alterations of existing buildings. These are laid out in Section 301 of this code:

Option 1: Work for alteration, change of occupancy or addition of all existing buildings shall be done in accordance with the Prescriptive Compliance Method given in Chapter 5.

Option 2: Work for alteration, change of occupancy or addition of all existing buildings shall be done in accordance with the Work Area Compliance Method given in Chapters 6 through 12.

Option 3: Work for alteration, change of occupancy or addition of all existing buildings shall be done in accordance with the Performance Compliance Method given in Chapter 13.

Under limited circumstances, a building alteration can be made to comply with the laws under which the building was originally built, as long as the accessibility requirements are met, there has been no substantial structural damage and there will be limited structural alteration. Flood hazard provisions also must still be addressed where there is a substantial improvement.

Note that all repairs must comply with Chapter 4 and all relocated buildings are addressed by Chapter 14.

LETTER DESIGNATIONS IN FRONT OF SECTION NUMBERS

The bracketed letter designations for the party responsible for portions of this code are as follows:

ICC Code Development Committee

[A] = Administrative Code Development Committee
[BE] = IBC—Egress Code Development Committee
[BF] = IBC—Fire Safety Code Development Committee
[BG] = IBC—General Code Development Committee
[BS] = IBC—Structural Code Development Committee
[E] = Developed under the ICC's Standard Development Process
[EB] = International Existing Building Code Development Committee
[F] = International Fire Code Development Committee
[FG] = International Fuel Gas Code Development Committee
[M] = International Mechanical Code Development Committee
[P] = International Plumbing Code Development Committee
[SP] = International Swimming Pool and Spa Code Development Committee

New York State Code Development

[NY] = New York State Department of State

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ARRANGEMENT AND FORMAT OF THE 2025 EBCNYS

The format of the EBCNYS allows each chapter to be devoted to a particular subject. The following table shows how the EBCNYS is divided. The subsequent table shows EBCNYS requirements that are correlated with other NYS Codes. The chapter synopses detail the scope and intent of the provisions of the EBCNYS.

CHAPTER TOPICS	
CHAPTER	**SUBJECTS**
1, 2	Administrative Requirements and Definitions
3	Provisions for all Compliance Methods
4	Repairs
5	Prescriptive Compliance Method for Existing Buildings
6–12	Work Area Compliance Method for Existing Buildings
13	Performance Compliance Method for Existing Buildings
14	Relocated Buildings
15	Construction Safeguards
16	Referenced Standards
Appendix A	Guidelines for Seismic Retrofit of Existing Buildings
Appendix B	Supplementary Accessibility Requirements for Existing Buildings
Appendix C	Guidelines for Wind Retrofit of Existing Buildings
Appendix D	Reserved
Appendix E	Temporary Emergency Uses
Appendix F	Diaper Changing Stations
Resource A	Guidelines on Fire Ratings of Archaic Materials and Assemblies

BUILDING CODE OF NEW YORK STATE CORRELATED TOPICS

The EBCNYS requirements for construction safeguards are directly correlated to the requirements of the BCNYS. The following table shows chapters of the BCNYS that are correlated with the EBCNYS:

EBCNYS/**BCNYS CORRELATED TOPICS**		
EBCNYS CHAPTER/SECTION	**BCNYS CHAPTER/SECTION**	**SUBJECT**
Chapter 15	Chapter 33	Construction safeguards

Chapter 1 Scope and Administration.

Chapter 1 establishes the limits of applicability of the code and describes how the code is to be applied and enforced. The provisions of Chapter 1 establish the authority and duties of the code official appointed by the authority having jurisdiction and also establish the rights and privileges of the design professional, contractor and property owner.

Chapter 2 Definitions.

Chapter 2 is the repository of the definitions of terms used in the body of the code. The user of the code should be familiar with and consult this chapter because the definitions are essential to the correct interpretation of the code and because the user may not be aware that a term is defined.

Chapter 3 Provisions for All Compliance Methods.

Chapter 3 guides the use of the three compliance methods of the EBCNYS and provides requirements that apply globally. The globally applicable requirement include general requirements related to buildings materials and other applicable codes, storm shelters, structural loads, in-situ load tests, accessibility, smoke alarms, carbon monoxide detection and exterior wall coverings.

Chapter 4 Repairs.

Chapter 4, a chapter independent of the three compliance methods, governs the repair of existing buildings. The provisions define conditions under which repairs may be made using materials and methods like those of the original construction or the extent to which repairs must comply with requirements for new buildings.

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Chapter 5 Prescriptive Compliance Method.

Chapter 5 provides one of the three main options of compliance available in the EBCNYS for buildings and structures undergoing alteration, addition or change of occupancy. The base requirements are more administrative in nature. The structural triggers for upgrades are consistent with the Work Area Method.

Chapter 6 Classification of Work.

Chapter 6 provides an overview of the Work Area Method and defines the different classifications of work including alterations, change of occupancy, additions and historic buildings. Detailed requirements for all of these are given in subsequent Chapters 7 through 12.

Chapter 7 Alterations—Level 1.

Chapter 7 provides the technical requirements for those existing buildings that undergo Level 1 alterations as described in Section 602, which includes replacement or covering of existing materials, elements, equipment or fixtures using new materials for the same purpose. This chapter is distinguished from Chapters 8 and 9 by only involving replacement of building components with new components with no reconfiguration of space.

Chapter 8 Alterations—Level 2.

A Level 2 alteration is an alteration involving space reconfiguration that could be up to and including 50 percent of the area of the building or addition of a new building system. Level 2 alterations also include the extension or addition of any system or equipment. The purpose of Chapter 8 is to provide detailed requirements and provisions to identify the required improvements in the existing building elements, means of egress, fire protection, structural systems, energy efficiency, and other building systems include electrical, mechanical and plumbing when a building is being altered.

Chapter 9 Alterations—Level 3.

Chapter 9 provides the technical requirements for those existing buildings that undergo Level 3 alterations. Level 3 alterations are those involving alterations that cover 50 percent of the aggregate area of the building. Under certain situations, this chapter also intends to improve the safety of certain building features beyond the work area and in other parts of the building where no alteration work might be taking place.

Chapter 10 Change of Occupancy.

The purpose of Chapter 10 is to address existing buildings that are subject to a change of occupancy. This chapter is an assembly of requirements to upgrade safety without having to comply fully as a new building. A change of occupancy classification is considered a change of occupancy, however, it will involve a higher level of regulation since the use of the building has made a more significant change.

Chapter 11 Additions.

Chapter 11 provides the requirements for additions, which are considered new construction. The requirements focus on safely integrating the addition with the existing building. This includes issues such as limiting the overall height and area of the building where the addition is not separated by a fire wall.

Chapter 12 Historic Buildings.

Chapter 12 provides exceptions to the application of the work area (Chapters 7 through 11) for buildings that are accredited as being of historic significance by a state or local authority. In addition, there is the ability provided to generate a report documenting how the intent of the code is met where strict code compliance is not possible. The provisions of this chapter primarily focus on fire and life safety and structural integrity.

Chapter 13 Performance Compliance Methods.

Chapter 13 allows for existing buildings to be evaluated to show that alterations or a change of occupancy, while not meeting new construction requirements, will provide a level of safety to demonstrate compliance. Provisions are based on a numerical scoring system involving 21 safety parameters where, when evaluated, such buildings must meet a minimum overall safety score.

Chapter 14 Relocated or Moved Buildings.

Chapter 14 is applicable to any building that is moved or relocated. This chapter is independent of any of the three compliance methods and focuses on the structural loads where the building is being relocated.

Chapter 15 Construction Safeguards.

Chapter 15 establishes specific regulations in order to minimize the risk to the public and adjacent property during construction. Additionally, this chapter addresses fire and life safety and means of egress during the construction process. This includes require-

ments for a site safety plan. This chapter is also consistent with Chapter 33 of the BCNYS and Chapter 33 of the *Fire Code of New York State* (FCNYS).

Chapter 16 Referenced Standards.

Chapter 16 lists all of the product and installation standards and codes that are referenced throughout Chapters 1 through 15 and includes identification of the promulgators and the section numbers in which the standards and codes are referenced. As stated in Section 102.4, these standards and codes become an enforceable part of the code (to the prescribed extent of the reference) as if printed in the body of the code.

Appendix A Guidelines for the Seismic Retrofit of Existing Buildings.

Appendix A provides guidelines for upgrading the seismic resistance capacity of different types of existing buildings. It is organized into separate chapters which deal with buildings of different types, including unreinforced masonry buildings, reinforced concrete and reinforced masonry wall buildings, and lightframe wood buildings. This appendix includes its own referenced standards.

Appendix B Supplementary Accessibility Requirements for Existing Buildings and Facilities.

Chapter 11 of the BCNYS contains provisions that set forth requirements for accessibility to buildings and their associated sites and facilities for people with physical disabilities. Section 306 addresses accessibility provisions and alternatives permitted in existing buildings. Appendix B was added to address accessibility in construction for items that are not typically enforceable through the traditional building code enforcement process.

Appendix C Guidelines for the Wind Retrofit of Existing Buildings.

The purpose of Appendix C is to provide voluntary prescriptive alternatives for addressing the retrofit of buildings in high-wind areas. Currently, there are two chapters which deal with the retrofit of gable ends and the fastening of roof decks, Appendix Chapters C1 and C2, respectively. This appendix includes its own referenced standards.

Appendix D Reserved.

Appendix E Temporary Emergency Uses.

Appendix E is intended to provide guidance for designers, engineers, architects and fire and building officials on allowing temporary emergency uses of existing buildings with respect to the minimum code requirements. This appendix is a template or checklist that references the relevant code requirement of concerns.

Appendix F Diaper Changing Stations.

In 2018, the New York State Legislature passed regulations requiring certain occupancies to install and maintain baby diaper changing stations that would be available to both men and women. This appendix establishes the standards for the installation of diaper changing stations in all newly constructed buildings that have one or more areas classified as Group A occupancies or Group M occupancies and in all existing buildings that have one or more areas classified as Group A occupancies or Group M occupancies and undergo a substantial renovation.

Resource A Guidelines on Fire Ratings of Archaic Materials and Assemblies.

In the process of repair and alteration of existing buildings, based on the nature and the extent of the work, the EBCNYS might require certain upgrades in the fire-resistance rating of building elements, at which time it becomes critical for the designers and the code officials to be able to determine the fire-resistance rating of the existing building elements as part of the overall evaluation for the assessment of the need for improvements. These guidelines are based upon the *Guideline on Fire Ratings of Archaic Materials* published by the National Institute of Building Sciences (NIBS).

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CHAPTER

1

SCOPE AND ADMINISTRATION

User notes:

About this chapter: *This chapter contains provisions for the application, enforcement and administration of subsequent requirements of the code. In addition to establishing the scope of the code, Chapter 1 identifies which buildings and structures come under its purview.*

SECTION 101—SCOPE AND GENERAL REQUIREMENTS

[NY] 101.1 Title. This publication shall be known as the 2025 edition of the *Existing Building Code of New York State*, hereinafter referred to as "this code." This code is part of the New York State Uniform Fire Prevention and Building Code (the "Uniform Code").

[NY] 101.1.1 Amendments of New York State code books. In Chapter 1, the term **"**New York State code books" shall include the *Residential Code of New York State*, the *Building Code of New York State*, the *Plumbing Code of New York State*, the *Mechanical Code of New York State*, the *Fuel Gas Code of New York State*, the *Fire Code of New York State*, the *Property Maintenance Code of New York State*, the *Existing Building Code of New York State* (i.e., this publication), and the *Energy Conservation Construction Code of New York State*. Provisions in any one or more of the New York State code books may be amended from time to time by provisions in 19 NYCRR Parts 1220 to 1227 or 19 NYCRR Part 1240, as currently in effect and as hereafter amended from time to time. If this publication is now or hereafter so amended, references in this publication to "this code" shall be deemed to be references to this publication as so amended. If any other New York State code book is now or hereafter so amended, references in this code to such other New York State code book shall be deemed to be references to such New York State code book as so amended.

[NY] 101.2 Scope. The provisions of this code shall apply to the *repair*, *alteration*, *change of occupancy*, *addition* to and relocation of *existing buildings*.

Exceptions:

1. The provisions of this code or the *Residential Code of New York State* shall apply to the construction, *alteration*, movement, enlargement, replacement, *repair*, equipment, use and occupancy, relocation, removal and demolition of the following *buildings* and structures, provided that such *buildings* or structures are not more than three stories above grade plane in height, and their accessory structures not more than three stories above grade plane in height:
   1.1. Detached one-family dwellings.
   1.2. Detached two-family dwellings in which each dwelling unit has a separate means of egress.
   1.3. *Townhouses*.
   1.4. Bed and breakfast dwellings.
   1.5. Live/work units that are located in *townhouses* and comply with the requirements of Section 508.5 of the *Building Code of New York State*.
   1.6. Owner-occupied lodging houses that have five or fewer guestrooms and are provided with an automatic sprinkler system complying with Section P2904 of the *Residential Code of New York State*.
2. *Agricultural buildings*, including barns, sheds, poultry houses and other buildings and equipment on the premises that are used directly and solely for agricultural purposes, shall not be subject to the construction-related provisions of this code.
3. Construction trailers that are used as temporary offices for the purpose of monitoring construction at a construction site shall not be subject to this code.
4. Structures such as radio and television transmission, communication and wind generation towers, and ground-mounted photovoltaic arrays that are neither a *building* appurtenance nor are attached to a *building* shall not be subject to this code.
5. Standards for construction of sleeping quarters in a children's overnight camp as defined in Public Health Law Section 1392(1) shall be governed by Public Health Law Section 1394(1) and the regulations promulgated by the Public Health Council. See Executive Law Section 378(1). As of the date of this publication, the Public Health Council's regulations for children's overnight camps are found in 10 NYCRR Subpart 7-2 ("Children's Camps").

[NY] 101.2.1 Appendices. Provisions in the following appendices have been adopted and are part of this code:

Appendix A	Guidelines for the Seismic Retrofit of Existing Buildings
Appendix E	Temporary Emergency Uses
Appendix F	Diaper Changing Stations
Resource A	Guidelines On Fire Ratings of Archaic Materials And Assemblies

In addition, the following appendices are included for informational purposes:

Appendix B	Supplementary Accessibility Requirements for Existing Buildings and Facilities
Appendix C	Guidelines for the Wind Retrofit of Existing Buildings

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101.2.2 Application of fire code. Where work regulated by this code is also regulated by the construction requirements for *existing buildings* in Chapter 11 of the *Fire Code of New York State,* such work shall comply with applicable requirements in both codes.

[NY] 101.2.3 Facilities regulated by State departments and agencies. Where a *building* or premises under the custody, licensure, supervision or jurisdiction of a department or agency of the State of New York is regulated as a one- or two-family dwelling or multiple single-family dwelling (*townhouse*), in accordance with established laws or regulations of that department or agency, said buildings or premises, such as a community residence or hospice residence, and their accessory structures shall comply with the provisions of this code or the *Residential Code of New York State*.

[A] 101.3 Purpose. The intent of this code is to provide flexibility to permit the use of alternative approaches to achieve compliance with minimum requirements to provide a reasonable level of safety, health, property protection and general welfare insofar as they are affected by the *repair*, *alteration*, *change of occupancy*, *addition* and relocation of *existing buildings*.

[NY] 101.4 Applicability. This code shall apply to the *repair*, *alteration*, *change of occupancy*, *addition* and relocation of *existing buildings*, regardless of occupancy, subject to the criteria of Sections 101.4.1 and 101.4.2. For the purposes of this section, the "date of adoption of this code" shall be deemed to be 90th day after the date on which the Notice of Adoption of the rule incorporating this code by reference in Part 1227 of the New York Codes, Rules, and Regulations shall have been published in the State Register.

[A] 101.4.1 Buildings not previously occupied. A building or portion of a building that has not been previously occupied or used for its intended purpose, in accordance with the laws in existence at the time of its completion, shall be permitted to comply with the provisions of the laws in existence at the time of its original permit unless such permit has expired. Subsequent permits shall comply with the *Building Code of New York State* or *Residential Code of New York State*, as applicable, for new construction.

[A] 101.4.2 Buildings previously occupied. The legal occupancy of any building existing on the date of adoption of this code shall be permitted to continue without change, except as is specifically covered in this code, the *Fire Code of New York State*, or the *Property Maintenance Code of New York State*, or as is deemed necessary by the *code official* for the general safety and welfare of the occupants and the public.

[A] 101.5 Safeguards during construction. Construction work covered in this code, including any related demolition, shall comply with the requirements of Chapter 15.

[NY] 101.6 Reserved.

[NY] 101.7 Provisions included in Uniform Code. The purpose of this chapter is to include, in the *Uniform Code,* provisions requiring persons and entities who construct, renovate, use and occupy *buildings* and structures to apply for and obtain building permits, to facilitate construction inspections, to obey stop work orders, to obtain certificates of occupancy, and to obtain operating permits. The provisions in this chapter are considered to be integral parts of the *Uniform Code*'s standards for construction, maintenance, and fire protection equipment and systems.

[NY] 101.7.1 Definition. For the purpose of this chapter, the term "other applicable law" shall include the *authority having jurisdiction's Code Enforcement Program*; any local law, ordinance, or regulation establishing the *authority having jurisdiction's Code Enforcement Program*; and any other applicable statute, regulation, rule, local law, or ordinance.

SECTION 102—APPLICABILITY

[A] 102.1 General. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall be applicable. Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern.

[NY] 102.2 Other laws and regulations. This code is part of the *Uniform Code* promulgated pursuant to Article 18 of the New York State Executive Law. The provisions of this code shall not be deemed to nullify any federal, state or local law, ordinance, administrative code, rule or regulation relating to any matter as to which the *Uniform Code* does not provide.

However:

1. Pursuant to Section 383(1) of the Executive Law, and except as otherwise provided in paragraphs a, b, and c of Section 383(1) of the Executive Law, the provisions of the *Uniform Code* supersede any other provision of a general, special or local law, ordinance, administrative code, rule or regulation inconsistent or in conflict with the *Uniform Code*;
2. Pursuant to Section 379(3) of the Executive Law, no city, town, village, county or other municipality shall have the power to supersede, void, repeal, or make less restrictive any provision of the *Uniform Code*; and
3. The ability of any city, town, or village, or the County of Nassau, to enact or adopt, and to enforce, a local law or ordinance imposing higher or more restrictive standards for construction within the jurisdiction of such city, town, village, or county that are applicable generally to such city, town, village, or county in the *Uniform Code* is subject to the provisions and requirements of Section 379 of the Executive Law.

Nothing in this section shall be construed as:

1. Affecting the authority of the State Labor Department to enforce a safety or health standard issued under provisions of Sections 27 and 27-a of the Labor Law;
2. Relieving a person from complying with a stricter standard issued pursuant to the Occupational Safety and Health Act of 1970, as amended; or
3. Superseding, limiting, impairing or otherwise affecting any provision of the *Uniform Code*, as now in effect and as hereafter amended from time to time.

[NY] 102.2.1 Other New York Codes, Rules and Regulations (NYCRR). Additional New York Codes, Rules and Regulations exist that may affect new and existing buildings, structures, systems and equipment. Such regulations include, but are not limited to:

1. 19 NYCRR Part 300 (Universal Symbol of Access);
2. 19 NYCRR Part 1261 (Recordkeeping - Smoke Detectors in Multiple Dwellings);
3. 19 NYCRR Part 1264 (Identification of Buildings Utilizing Truss Type Construction); and
4. 19 NYCRR Part 1265 (Residential Structures with Truss Type Construction, Pre-Engineered Wood Construction and/or Timber Construction).

[NY] 102.2.2 Change in use or occupancy. No change shall be made in the use or occupancy of any *building* or structure unless such *building* or structure is made to comply with the requirements of the *Uniform Code* and *Energy Code*.

[A] 102.3 Application of references. References to chapter or section numbers or to provisions not specifically identified by number shall be construed to refer to such chapter, section or provision of this code.

[NY] 102.4 Referenced codes and standards. The codes and standards referenced in this code shall be considered part of the requirements of this code to the prescribed extent of each such reference and as further regulated in Sections 102.4.1 and 102.4.2.

[A] 102.4.1 Conflicts. Where conflicts occur between provisions of this code and referenced codes and standards, the provisions of this code shall apply.

[A] 102.4.2 Conflicting provisions. Where the extent of the reference to a referenced code or standard includes subject matter that is within the scope of this code, the provisions of this code, as applicable, shall take precedence over the provisions in the referenced code or standard.

[NY] 102.5 Partial invalidity. In the event that any part or provision of this code is held by a court of competent jurisdiction to be illegal or void, this shall not have the effect of making void or illegal any of the other parts or provisions.

[NY] 102.6 Existing structures. The legal occupancy of any structure existing on the effective date of this code shall be permitted to continue without change, except as otherwise specifically provided in this code or any other applicable provision of the *Uniform Code*. For the purposes of this section, the "effective date of this code" shall be deemed to be December 31, 2025.

[NY] SECTION 103—ADMINISTRATION AND ENFORCEMENT

[NY] 103.1 Administration and enforcement. The *Uniform Code* shall be administered and enforced by the *authority having jurisdiction*. The identity of the *authority having jurisdiction* in a given situation is determined in accordance with Article 18 of the Executive Law and the regulations promulgated by the Secretary of State pursuant to Executive Law Section 381(1). In general, the *authority having jurisdiction* is the local government (city, town or village) in which the *building* or structure is located. In certain situations, the *authority having jurisdiction* may be the county in which the *building* or structure is located. In certain other cases, the State, the Secretary of State (acting through the Department of State) or some other State agency may be the *authority having jurisdiction*. The *authority having jurisdiction* responsible for administration and enforcement of the *Uniform Code* is also responsible for administration and enforcement of the *Energy Code*.

Administration and enforcement of the *Uniform Code* and *Energy Code* shall be in accordance with the following, as applicable:

1. Where a city, town, village or county is the authority having jurisdiction:
   - 1.1. Such city, town, village or county shall provide for administration and enforcement of the *Uniform Code* and *Energy Code* by local law, ordinance, other appropriate regulation, or combination thereof.
   - 1.2. The *Code Enforcement Program* established by such local law, ordinance or other appropriate regulation, or combination thereof, must include, at a minimum, the features described in *Part 1203* and must satisfy all other requirements of *Part 1203*.
   - 1.3. Such city, town, village or county shall administer and enforce the *Uniform Code* and *Energy Code* in accordance with the *Code Enforcement Program* established by such local law, ordinance or other appropriate regulation, or combination thereof.
2. Where the State is the *authority having jurisdiction* pursuant to 19 NYCRR Section 1201.2(d):
   - 2.1. The *Code Enforcement Program* shall be as established by *Part 1204*.
   - 2.2. The State, acting through one or more State agencies, shall administer and enforce the *Uniform Code* and *Energy Code* in accordance with *Part 1204*.
3. Where the Department of State is the *authority having jurisdiction*:
   - 3.1. The *Code Enforcement Program* shall be as established by *Part 1202*.
   - 3.2. The Department of State shall administer and enforce the *Uniform Code* and *Energy Code* in accordance with *Part 1202*.
4. Where any governmental unit or agency not included in paragraphs 1, 2, and 3 above is the *authority having jurisdiction*:
   - 4.1. Such governmental unit or agency shall provide for administration and enforcement of the *Uniform Code* and *Energy Code* by regulation.
   - 4.2. The *Code Enforcement Program* established by such regulation must include, at a minimum, the features described in *Part 1203* and must satisfy all other requirements of *Part 1203*.

4.3. Such governmental unit or agency shall administer and enforce the *Uniform Code* and *Energy Code* in accordance with the *Code Enforcement Program* established by such regulation.

Every governmental unit or agency thereof charged with administration and enforcement of the *Uniform Code* shall exercise its powers in due and proper manner so as to extend to the public protection from the hazards of fire and inadequate building construction.

Any person or entity constructing or renovating a *building* or structure, changing the use or occupancy of a *building* or structure, or engaging in any other activity that is subject to the provisions of the *Code Enforcement Program* of the *authority having jurisdiction* responsible for administration and enforcement of the *Uniform Code* with respect to such *building* shall comply with all applicable provisions of such *Code Enforcement Program*.

In addition, persons and entities who construct, renovate, use and occupy *buildings* and structures shall comply with all applicable provisions of Chapter 1.

[NY] 103.1.1 Due process. Nothing in Chapter 1, elsewhere in the *Uniform Code*, or in any regulation promulgated pursuant to Executive Law Section 381(1), shall be construed as authorizing any *authority having jurisdiction* to administer and enforce the *Uniform Code* in a manner that deprives any person or entity of due process of law. For example, when posting, placarding and/or condemning buildings or structures that are *unsafe*, unfit for human occupancy or unlawful, notice and opportunity to be heard (and, if applicable, right of appeal) may be required under the applicable Constitutional provisions prior to posting, placarding, and/or condemning such *building* or structure and/or removing any owner or occupancy or causing any owner or occupant to be removed from any such *building* or structure.

[NY] 103.1.2 Post-action hearing in cases of imminent danger. In cases of imminent danger, posting, placarding, and condemning a *building* or structure and removing owners and occupants or causing owners and occupants to be removed without first providing an opportunity to be heard shall be permitted to the extent consistent with applicable Constitutional provisions, provided that the affected persons and entities are afforded the opportunity for a post-action hearing to the extent required by applicable Constitutional provisions.

[NY] 103.2 Reserved.

[NY] 103.3 Reserved.

[NY] SECTION 104—MATERIALS, EQUIPMENT AND METHODS OF CONSTRUCTION

[NY] 104.1 Reserved.

[NY] 104.2 Determination of compliance.

[NY] 104.2.1 Reserved.

[NY] 104.2.2 Reserved.

[NY] 104.2.3 Alternative materials, designs and methods of construction, and equipment. The provisions of this code are not intended to prevent the installation of any materials, equipment, or appliances not specifically prescribed by this code, or to prohibit any designs or methods of construction not specifically prescribed by this code, provided that any such alternative is not specifically prohibited by any provision of this code, the *Uniform Code*, or the *Energy Code*, and has been *approved*, in writing, by the *code official*. Alternative materials, equipment, appliances, designs, or methods of construction may be *approved* only when the *code official* shall have determined, in writing, that such alternative is:.

1. Satisfactory and complies with the intent of the provisions and requirements of the *Uniform Code*; and
2. Not less than the equivalent of that prescribed in the *Uniform Code* in quality, strength, effectiveness, fire resistance, durability, and safety.

Nothing in this section shall be construed as permitting any *code official* or any *authority having jurisdiction* to waive, vary, modify or otherwise alter any provision or requirement of this code or any other provision or requirement of the *Uniform Code*.

[NY] 104.2.4 Reserved.

[NY] 104.3 Applications and permits. The *authority having jurisdiction* shall receive applications, review construction documents, issue permits, inspect the premises for which such permits have been issued and enforce compliance with the provisions of this code.

[NY] 104.3.1 Determination of substantially improved or substantially damaged existing buildings and structures in flood hazard areas. For applications for a building permit for reconstruction, rehabilitation, *addition*, *alteration*, *repair* or other improvement of *existing buildings* or structures located in *flood hazard areas*, the *code official* shall examine or cause to be examined the *construction documents* and the construction estimate of the value of the proposed work provided by the applicant. For *buildings* or structures that have sustained damage of any origin, the value of the proposed work shall include the cost to *repair* the *building* or structure to its predamaged condition. If the *code official* determines that the proposed work constitutes *substantial improvement* or *repair* of *substantial damage*, then the *code official* shall require the building to meet the requirements of Section 1612 of the *Building Code of New York State,* or Section R306 of the *Residential Code of New York State*, as applicable.

Where the *building* or *structure* has sustained *substantial damage*, *repairs* necessary to restore the *building* or *structure* to its predamaged condition shall be considered *substantial improvements* regardless of the actual repair work performed.

[NY] 104.3.2 Preliminary meeting. The *code official* is authorized to require that the prospective applicant meet to discuss plans for any proposed work or *change of occupancy* under these provisions prior to the issuance of the permit. The purpose of this

preliminary meeting is for the *code official* to gain an understanding of the prospective applicant's intentions for the proposed work, and to determine, together with the prospective applicant, the specific applicability of this code.

[NY] 104.3.3 Building evaluation. The *authority having jurisdiction* is authorized to require an *existing building* to be investigated and evaluated by a registered design professional based on the circumstances agreed on at the preliminary meeting. The design professional shall notify the *code official* if any potential noncompliance with the provisions of this code is identified.

[NY] 104.4 Reserved.

[NY] 104.5 Reserved.

[NY] 104.6 Reserved.

[NY] 104.7 Reserved.

[NY] 104.8 Reserved.

[NY] 104.9 Approved materials and equipment. Materials, equipment and devices *approved* by the *code official* shall be constructed and installed in accordance with such approval. Materials, equipment and devices tested by an *approved* testing laboratory shall be permitted to be constructed and installed in accordance with such *approval*.

[NY] 104.9.1 Used materials and equipment. Used materials, equipment and devices shall not be reused unless they meet the requirements of this code for new materials.

[NY] 104.10 Workmanship. *Repairs*, maintenance work, *alterations* or installations which are caused directly or indirectly by the enforcement of the *Uniform Code* shall be executed and installed in a workmanlike manner and in accordance with the *Uniform Code* and the manufacturer's installation instructions.

[NY] SECTION 105—BUILDING PERMITS, OPERATING PERMITS, AND CERTIFICATES OF OCCUPANCY

[NY] 105.1 Required permits. No person or entity shall commence, perform, or continue any work that must conform with the *Uniform Code* and/or *Energy Code* unless all of the following apply:

1. Such person or entity has applied to the *authority having jurisdiction* for a permit.
2. The *authority having jurisdiction* has issued a permit authorizing such work.
3. Such permit has not been revoked or suspended.
4. Such permit has not expired.

[NY] 105.2 Work exempt from permit requirement. A permit shall not be required for work in any category that is excluded from the permit requirement by the *authority having jurisdiction's Code Enforcement Program*, provided that *Part 1203* allows an *authority having jurisdiction* to exclude such category of work from the permit requirement. Exemptions from permit requirements shall not be deemed to grant authorization for any work to be done in any manner in violation of any provision of the *Uniform Code*, the *Energy Code*, or any other applicable law.

[NY] 105.3 Applications for building permits. A person or entity applying for a permit shall submit an application to the *authority having jurisdiction*. An application for a building permit shall include all of the following:

1. Construction documents that satisfy the requirements of Section 106.2.
2. Any and all other submittal documents required by Section 106.
3. Any and all other information and documentation that may be required by the stricter of the *authority having jurisdiction's Code Enforcement Program* or a *Part 1203—Compliant Code Enforcement Program*.
4. Such other information and documentation as the *authority having jurisdiction* may determine to be necessary to allow the *authority having jurisdiction* to determine whether the proposed work conforms with the *Uniform Code*, the *Energy Code*, and other applicable laws.

[NY] 105.3.1 Reserved.

[NY] 105.3.2 Reserved.

[NY] 105.3.3 Approval of construction documents. When the *authority having jurisdiction* issues a building permit, the *authority having jurisdiction* shall approve the construction documents in writing. Work shall be installed in accordance with the *approved* construction documents and the terms and conditions, if any, of the building permit.

[NY] 105.4 Validity of building permit. The issuance or granting of a permit shall not be construed to be a permit for, or an approval of, any violation of any of the provisions of the *Uniform Code*, the *Energy Code*, or any other applicable law. Permits presuming to give authority to violate or cancel any provision of this code, the *Uniform Code*, the *Energy Code*, or any other applicable law shall not be valid. The issuance of a permit based on construction documents and other data shall not prevent the *code official* from requiring the correction of errors in the construction documents and other data.

[NY] 105.5 Reserved.

[NY] 105.6 Suspension or revocation of building permit. The *authority having jurisdiction* is authorized to suspend or revoke a permit issued under the provisions of this code wherever the permit is issued in error; on the basis of incorrect, inaccurate or incomplete information; in violation of any provision of the *Uniform Code*, the *Energy Code*, or any other applicable law; or there has been a false statement or misrepresentation as to the material facts in the application or construction documents on which the permit or approval was based including, but not limited to, any one of the following:

1. The permit is used for a location or establishment other than that for which it was issued.
2. The permit is used for a condition or activity other than that listed in the permit.
3. Conditions and limitations set forth in the permit have been violated.
4. There have been any false statements or misrepresentations as to the material fact in the application for permit or plans submitted or a condition of the permit.
5. The permit is used by a different person or firm than the name for which it was issued.
6. The permittee failed, refused or neglected to comply with orders or notices duly served in accordance with the provisions of this code within the time provided therein.
7. The permit was issued in error or in violation of this code or any other applicable law.

Any such suspension or revocation shall be in writing, signed by an authorized agent of the *authority having jurisdiction*.

[NY] 105.7 Placement of building permit and approved construction documents. The building permit, or copy thereof, and at least one set of *approved* construction documents, shall be kept on the site of the work until the completion of the project.The *approved* construction documents shall be open to inspection by any authorized representative of the *authority having jurisdiction*.

[NY] 105.8 Operating permits. Where the stricter of the *authority having jurisdiction's Code Enforcement Program* or a *Part 1203—Compliant Code Enforcement Program* requires an operating permit to conduct an activity or to use a category of *building*, no person or entity shall conduct such activity or use such category of *building* without obtaining an operating permit from the *authority having jurisdiction*. The procedures for applying for, issuing, revoking, and suspending operating permits shall be as set forth in the stricter of the *authority having jurisdiction's Code Enforcement Program* or a *Part 1203—Compliant Code Enforcement Program*.

Exceptions:

1. Where specifically identified in the *code enforcement program*, an *authority having jurisdiction* may exempt the requirement for an operating permit for the processes or activities, or the *buildings*, structures, or facilities listed in Sections 105.5.1 through 105.5.61 of the *Fire Code of New York State*, provided that the use is expressly authorized by a certificate of occupancy or certificate of compliance, fire safety and property maintenance inspections are performed in accordance with Section 1203.3(h), and condition assessments are performed in compliance with Appendix C of the *Property Maintenance Code of New York State*, as applicable.
2. An operating permit shall not be required if periodic inspections are performed for compliance with the applicable provisions of the *Uniform Code* to conduct such activity or to use such category of *building* to the satisfaction of the *authority having jurisdiction*.

[NY] 105.9 Certificates of occupancy. Where the stricter of the *authority having jurisdiction*'s *Code Enforcement Program* or a *Part 1203—Compliant Code Enforcement Program* requires a *certificate of occupancy* for permission to use or occupy a *building* or structure, or any portion thereof, no *person* or entity shall use or occupy such *building* or *structure*, or portion thereof, unless all of the following apply:

1. The *authority having jurisdiction* has issued such *certificate of occupancy*.
2. Such *certificate of occupancy* has not been revoked or suspended.
3. In the case of a temporary *certificate of occupancy*, such temporary *certificate of occupancy* has not expired.

[NY] 105.9.1 Authorized uses and occupancies. Where a certificate of occupancy has been issued for a *building* or structure, or any portion thereof, no *person* or entity shall use or occupy such *building* or structure, or such portion thereof, for any use or occupancy other than that authorized by such *certificate of occupancy*.

[NY] 105.9.2 Change in use or occupancy. Without regard to whether a certificate of occupancy shall have been issued, no person or entity shall convert the use or occupancy of a *building* or structure, or any portion thereof, from one use or occupancy to another without first completing all of the following:

1. Obtaining a permit to perform the work, if any, required for such conversion.
2. Performing such work, if any.
3. Obtaining a certificate of occupancy from the *authority having jurisdiction*.

SECTION 106—CONSTRUCTION DOCUMENTS

[NY] 106.1 General. Submittal documents consisting of construction documents, statements of special inspections, structural observation programs, investigation and evaluation reports, geotechnical reports, and other data shall be submitted with each application for a building permit. The *authority having jurisdiction* may waive the requirement for *construction documents* where a *registered design professional* is not required by law and where either the work to be done involves minor *alterations* or *repairs*, or where plans and specifications are determined by the *authority having jurisdiction* to not be necessary to verify code compliance. Construction documents shall be in accordance with Sections 106.2 through 106.6.

[NY] 106.2 Construction documents. Construction documents shall be in accordance with Sections 106.2.1 through 106.2.8.

[NY] 106.2.1 Information on construction documents. Construction documents shall:

1. Define the scope of the proposed work;
2. Be of sufficient clarity to indicate the location, nature and extent of the proposed work;

3. Show in detail that the proposed work will conform to the provisions of the *Uniform Code*, the *Energy Code*, and other applicable laws;
4. Include all information required by any provision of this code or by any other applicable provisions of the *Uniform Code* or the *Energy Code*;
5. Include any and all additional information and documentation that may be required by the stricter of the *Code Enforcement Program* of the *authority having jurisdiction* or *Part 1203—Compliant Code Enforcement Program*; and
6. Be dimensioned and drawn to an appropriate scale.

[NY] 106.2.1.1 Manufacturer's installation instructions. Manufacturer's installation instructions, as required by any applicable provision of the *Uniform Code* or *Energy Code*, shall be available on the job site at the time of inspection.

[NY] 106.2.2 Fire protection system(s) shop drawings. Shop drawings for the fire protection system(s) shall be submitted to indicate compliance with Chapter 9 of the *Building Code of New York State*, this code, any other applicable provision of the *Uniform Code*, and the construction documents. Such shop drawings shall be *approved* prior to the start of system installation. Shop drawings shall contain information as required by the referenced installation standards in Chapter 9 of the *Building Code of New York State* or in any other applicable provision of the *Uniform Code*.

[NY] 106.2.3 Means of egress. The construction documents shall show in sufficient detail the location, construction, size and character of all portions of the means of egress, including the path of the exit discharge to the public way, in compliance with the provisions of the *Uniform Code*. In other than occupancies in Groups R-2, R-3, and I-1, the construction documents shall designate the number of occupants to be accommodated on every floor and in all rooms and spaces.

[NY] 106.2.4 Exterior wall envelope. Construction documents for work affecting the *exterior wall envelope* shall describe the *exterior wall envelope* in sufficient detail to determine compliance with the *Uniform Code* and *Energy Code*. The construction documents shall provide details of the *exterior wall envelope* as required, including windows, doors, flashing, intersections with dissimilar materials, corners, end details, control joints, intersections at roof, eaves or parapets, means of drainage, water-resistive barriers and details around openings.

The construction documents shall include manufacturer's installation instructions that provide supporting documentation that the proposed penetration and opening details described in the construction documents maintain the wind and weather resistance of the *exterior wall envelope*. The supporting documentation shall fully describe the exterior wall system that was tested, where applicable, as well as the test procedure used.

[A] 106.2.5 Exterior balconies and elevated walking surfaces. Where the scope of work involves balconies or other elevated walking surfaces have weather-exposed surfaces, and the structural framing is protected by an impervious moisture barrier, the construction documents shall include details for all elements of the impervious moisture barrier system. The construction documents shall include manufacturer's installation instructions.

[NY] 106.2.6 Site plan. The construction documents submitted with the application for building permit shall be accompanied by a site plan showing to scale the size and location of new construction and *existing structures* on the site, distances from lot lines, the established street grades, the proposed finished grades; and as applicable, flood hazard areas, floodways, and design flood elevations. The site plan shall be drawn in accordance with an accurate boundary line survey. In the case of demolition, the site plan shall show construction to be demolished and the location and size of *existing structures* and construction that are to remain on the site or plot. The *code official* is authorized to waive or modify the requirement for a site plan where the application for building permit is for *alteration*, *repair,* or where otherwise warranted.

[NY] 106.2.6.1 Design flood elevations. Where design flood elevations are not specified, they shall be established in accordance with Section 1612.3.1 of the *Building Code of New York State*.

[NY] 106.2.6.2 Flood hazard documentation. If located in a *flood hazard area*, documentation of the elevation of the l*owest floor* as required in Section 1612.4 of the *Building Code of New York State* shall be submitted to the *code official* prior to the final inspection.

[NY] 106.2.7 Structural information. The construction documents shall provide the information specified in Section 1603 of the *Building Code of New York State*.

[NY] 106.2.8 Relocatable buildings. Construction documents for *relocatable buildings* shall comply with Section 3113 of the *Building Code of New York State*.

[NY] 106.3 Reserved.

[NY] 106.4 Reserved.

[NY] 106.5 Reserved.

[NY] 106.6 Design professional. Construction documents shall be prepared by a registered design professional where required by Article 145 or Article 147 of the New York State Education Law, by the stricter of *Code Enforcement Program* of the *authority having jurisdiction* or a *Part 1203—Compliant Code Enforcement Program*, or by any other applicable law.

[NY] SECTION 107—TEMPORARY STRUCTURES

[NY] 107.1 General. Temporary structures shall conform to Section 3103 of the *Building Code of New York State* and Chapter 31 of the *Fire Code of New York State*.

[NY] 107.2 Reserved.

[NY] 107.3 Reserved.

[NY] 107.4 Reserved.

[NY] SECTION 108—RESERVED

SECTION 109—INSPECTIONS

[NY] 109.1 Construction inspections. Any person or entity performing work for which a building permit has been issued shall keep work accessible and exposed until the work has been inspected and accepted by the *authority having jurisdiction*, or its authorized agent, at each element of the construction process that is applicable to the work and specified in the stricter of the *authority having jurisdiction's Code Enforcement Program* or a *Part 1203—Compliant Code Enforcement Program*.

[NY] 109.2 Reserved.

[NY] 109.3 Reserved.

[NY] 109.4 Reserved.

[A] 109.5 Inspection requests. It shall be the duty of the holder of the building permit or their duly authorized agent to notify the *code official* when work is ready for inspection. It shall be the duty of the permit holder to provide access to and means for any inspections of such work that are required by this code.

[NY] 109.6 Reserved.

SECTION 110—CERTIFICATE OF OCCUPANCY

[NY] 110.1 Change in use or occupancy. Without regard to whether a certificate of occupancy shall have been issued, no person or entity shall convert the use or occupancy of a *building* or structure, or any portion thereof, from one use or occupancy to another without first completing all of the following:

1. Obtaining a building permit to perform the work, if any, required for such conversion.
2. Performing such work, if any.
3. Obtaining a certificate of occupancy from the *authority having jurisdiction*.

[NY] 110.2 Certificates of occupancy. Where the stricter of the *authority having jurisdiction's Code Enforcement Program* or a *Part 1203—Compliant Code Enforcement Program* requires a certificate of occupancy for permission to use or occupy a *building* or structure, or any portion thereof, no person or entity shall use or occupy such *building* or structure, or such portion thereof, unless:

1. The *authority having jurisdiction* has issued such certificate of occupancy.
2. Such certificate of occupancy has not been revoked or suspended.
3. In the case of a temporary certificate of occupancy, such temporary certificate of occupancy has not expired.

[NY] 110.2.1 Authorized uses and occupancies. Where a certificate of occupancy has been issued for a *building* or structure, or any portion thereof, no person or entity shall use or occupy such *building* or structure, or such portion thereof, for any use or occupancy other than that authorized by such certificate of occupancy.

[NY] 110.3 Reserved.

[NY] 110.4 Reserved.

SECTION 111—SERVICE UTILITIES

[NY] 111.1 Connection of service utilities. Connections from a utility, source of energy, fuel, or power to any *building* or system that is regulated by the *Uniform Code* shall be made in accordance with the requirements of the Uniform Code; the regulations of the public utility providing such utility, source of energy, fuel or power; and the regulations of any governmental unit or agency having jurisdiction over such utility, source of energy, fuel or power.

[NY] 111.2 Temporary connection. Where *approved* by the *code official,* temporary connections from a utility, source of energy, fuel, or power to a building or system may be made. Temporary connections shall be made in accordance with Section 111.1.

[NY] 111.3 Notice of disconnection service utilities. The owner or the owner's authorized agent shall notify the *code official* of the disconnection of any utility service to the *building*, structure, or system regulated by this code.

[NY] SECTION 112—VARIANCES AND APPEALS

[NY] 112.1 Application for variance or appeal. An application for a variance or modification of any provision or requirement of *Uniform Code* shall be in accordance with the provisions of *Part 1205*. An appeal of any order or determination, or the failure within a reasonable time to make an order or determination, of an administrative official charged to enforce or purporting to enforce the *Uniform Code* may be made in accordance with the provisions of *Part 1205*.

[NY] 112.2 Limitations on authority. Nothing in this code shall be construed as permitting any *code official* or any *authority having jurisdiction* to waive, vary, modify, or otherwise alter any provision or requirement of this code or any other provision or requirement of the *Uniform Code*. Provisions or requirements of the *Uniform Code* may be varied or modified only in accordance with procedures established by *Part 1205* or by such other regulations as may hereafter be promulgated by the Secretary of State pursuant to Section 381(1)(f) of the Executive Law.

[NY] 112.3 Reserved.

[NY] 112.4 Reserved.

SECTION 113—VIOLATIONS

[NY] 113.1 Violations. Any violation of any provision set forth in this chapter shall be a violation of the *Uniform Code*, and any person or entity violating any such provision shall be subject to the penalties prescribed in Executive Law Section 382(2). In addition, to the extent that any act or omission that violates any provision set forth in this chapter is also a violation of any other applicable law, any person or entity guilty of such act or omission shall also be subject to the penalties prescribed in or otherwise applicable to a violation of such other applicable law.

[NY] 113.2 Reserved.

[NY] 113.3 Reserved.

[NY] 113.4 Reserved.

SECTION 114—STOP WORK ORDER

[NY] 114.1 Stop work orders. The *authority having jurisdiction* is authorized to issue a stop work order to halt work that is being performed without a required permit; work that is being performed after a required permit has been revoked or suspended or has expired; work that is being conducted in a *dangerous* or *unsafe* manner; or work that is contrary to provisions of the *Uniform Code*, the *Energy Code*, the *approved* construction documents, or the terms and conditions (if any) of the permit. No person or entity shall commence, perform or continue any work if the *authority having jurisdiction* has issued a stop work order with respect to such work.

[NY] 114.2 Reserved.

[NY] 114.3 Reserved.

[NY] 114.4 Reserved.

[NY] SECTION 115—RESERVED

[NY] SECTION 116—RESERVED

[NY] SECTION 117—RESERVED

[NY] SECTION 118—INSPECTION OF SOLID FUEL-BURNING HEATING APPLIANCES, CHIMNEYS AND FLUES

[NY] 118.1 General. This section is made part of the *Uniform Code* pursuant to Executive Law Section 378(5-c).

[NY] 118.2 Permit. Prior to the installation of any solid fuel-burning heating appliance, chimney or flue in any dwelling used as a residence, the owner thereof, or owner's agent, shall first secure a permit from the *authority having jurisdiction*.

[NY] 118.3 Installation and inspection. An appropriate and qualified inspector, as determined by the *authority having jurisdiction*, shall cause an inspection to be made of the solid fuel-burning heating appliance, chimney or flue at a time when such inspection will best determine conformity of such installation with the *Uniform Code*.

Exception: The *authority having jurisdiction* may waive such inspection for good cause shown.

[NY] 118.4 Certificate of compliance. Upon approval of such installation, the *code official* or other appropriate official of the *authority having jurisdiction* shall issue a certificate evidencing compliance with the appropriate provisions of the *Uniform Code* (such certificate being hereinafter referred to as a "certificate of compliance"). No owner of any dwelling used as a residence shall operate, or cause to be operated, any solid fuel-burning heating appliance until such installation, including chimney and flue, has been *approved* and a certificate of compliance has been obtained from the *authority having jurisdiction.*

[NY] 118.4.1 Accidental fire. In the event of an accidental fire in a solid fuel-burning heating appliance, chimney or flue requiring the services of a fire department, the chief of the responding fire department may issue a temporary thirty-day certificate indicating substantial conformity with the *Uniform Code*.

The *authority having jurisdiction* shall cause an inspection to be made by an official inspector, as determined by the *Code Enforcement Program* of the *authority having jurisdiction*, and a new certificate to be issued indicating conformity of such solid fuel-burning heating appliance, chimney or flue with the *Uniform Code*.

[NY] 118.4.2 Liability. Pursuant to Executive Law Section 378(5-c)(f), the issuance of a certificate of compliance shall not be deemed to give rise to any claim or cause of action for damages against the *authority having jurisdiction* or any official of the *authority having jurisdiction* for damages resulting from operation or use of such solid fuel-burning heating appliance, chimney or flue.

[NY] 118.5 Fee. The *authority having jurisdiction* may establish and collect a reasonable fee for such inspection from the owner of such property or such owner's agent.

[NY] 118.6 Violations. Pursuant to Executive Law Section 378(5-c)(h), any violation of this section shall be deemed a violation and shall be punishable by a fine not to exceed two hundred fifty dollars.

[NY] 118.7 Emergency repair. Where equipment replacements and *repairs* must be performed in an emergency situation and where a delay occasioned by the requirement of securing a permit could reasonably be expected to cause irreparable damage to the property or serious personal injury to the occupants or other person, the owner or their agent may commence such installation without first obtaining such permit provided application therefor is filed within three business days after such work is commenced.

CHAPTER

2 DEFINITIONS

User notes:

About this chapter: *Codes, by their very nature, are technical documents. Every word, term and punctuation mark can add to or change the meaning of a technical requirement. It is necessary to maintain a consensus on the specific meaning of each term contained in the code. Chapter 2 performs this function by stating clearly what specific terms mean for the purpose of the code.*

SECTION 201—GENERAL

[NY] 201.1 Scope. Unless otherwise expressly stated, the words and terms provided in italics shall, for the purposes of this code, have the meanings indicated in this chapter or as defined within the chapter or appendix where the word or term is found, except as provided in Sections 201.3 and 201.4.

[NY] 201.2 Interchangeability. Words and terms used in the present tense include the future; words and terms stated in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

[NY] 201.3 Words and terms defined in other codes. Where italicized words and terms are not defined in this code and are defined in the *Building Code of New York State*, *Energy Conservation Construction Code of New York State*, *Fire Code of New York State*, *Fuel Gas Code of New York State*, *Mechanical Code of New York State*, or *Plumbing Code of New York State*, such terms shall have the meanings ascribed to them in those codes.

[NY] 201.4 Words and terms not defined. Where words and terms are not italicized or are italicized but not defined through the methods authorized by this chapter, such words and terms shall have the meanings defined in applicable referenced standards, statutes, or regulations or ordinarily accepted meanings such as the context implies.

SECTION 202—GENERAL DEFINITIONS

[A] ADDITION. An extension or increase in floor area, number of stories, or height of a building or structure.

[NY] AGRICULTURAL BUILDING. A structure designed and constructed to house farm equipment, farm implements, poultry, livestock, hay, grain, or other horticultural products. This structure shall not be a place of human habitation or a place of employment where agricultural products are processed, treated or packaged, nor shall it be a place used by the public.

[A] ALTERATION. Any construction or renovation to an *existing structure* other than a *repair* or *addition*.

[BG] AMBULATORY CARE FACILITY. Buildings or portions thereof used to provide medical, surgical, psychiatric, nursing or similar care on a less than 24-hour basis to persons who are rendered incapable of self-preservation by the services provided or staff has accepted responsibility for care recipients already incapable.

[A] APPROVED. Acceptable to the *code official*.

[A] APPROVED AGENCY. An established and recognized organization that is regularly engaged in conducting tests, furnishing inspection services or furnishing product evaluation or certification where such organization has been approved by the code official.

[NY] AUTHORITY HAVING JURISDICTION. The governmental unit or agency responsible for administration and enforcement of this code.

[A] BUILDING. Any structure utilized or intended for supporting or sheltering any occupancy.

[NY] BUILDING CODE OF NEW YORK STATE. The 2025 edition of the publication entitled "Building Code of New York State," published by the International Code Council, Inc. (publication date July 2025).

[NY] BUILDING OFFICIAL. See "Code official."

[A] CHANGE OF OCCUPANCY. Any of the following shall be considered as a change of occupancy where the current *Building Code of New York State* requires a greater degree of safety, accessibility, structural strength, fire protection, means of egress, ventilation or sanitation than is existing in the current building or structure:

1. Any change in the occupancy classification of a building or structure.
2. Any change in the purpose of, or a change in the level of activity within, a building or structure.
3. A change of use.

[A] CHANGE OF USE. A change in the use of a building or a portion of a building, within the same group classification, for which there is a change in application of the code requirements.

[NY] CODE ENFORCEMENT PROGRAM. The program under which an *authority having jurisdiction* administers and enforces this code, as such program is currently in effect and as such program may hereafter be amended from time to time.

[NY] CODE OFFICIAL. The officer or other designated authority charged with the administration and enforcement of this code, or a duly authorized representative.

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[BS] DANGEROUS. Any building, structure or portion thereof that meets any of the conditions described below shall be deemed dangerous:

1. The building or structure has collapsed, has partially collapsed, has moved off its foundation or lacks the necessary support of the ground.
2. There exists a significant risk of collapse, detachment or dislodgement of any portion, member, appurtenance or ornamentation of the building or structure under permanent, routine or frequent loads; under actual loads already in effect; or under snow, wind, rain, flood, earthquake aftershock or other environmental loads when such loads are imminent.

[A] DEFERRED SUBMITTAL. Those portions of the design that are not submitted at the time of the application and that are to be submitted to the *code official* within a specified period.

[BS] DISPROPORTIONATE EARTHQUAKE DAMAGE. A condition of earthquake-related damage where both of the following occur:

1. The 0.3-second spectral acceleration at the building site for the earthquake in question, as estimated by one of the following, is less than 30 percent of the mapped acceleration parameter S_S:
    1.1. The United States Geological Survey's algorithm for the data point closest to the site.
    1.2. As determined from peer-reviewed seismograph records from the site or from locations closer to the site than the algorithm-provided data points.
2. The vertical elements of the lateral force-resisting system have suffered damage such that the lateral load-carrying capacity of any story in any horizontal direction has been reduced by more than 10 percent from its pre-earthquake condition.

[BE] EMERGENCY ESCAPE AND RESCUE OPENING. An operable exterior window, door or other similar device that provides for a means of escape and access for rescue in the event of an emergency.

[NY] ENERGY CODE. The New York State Energy Conservation Construction Code, adopted pursuant to Article 11 of the New York State Energy Law.

[NY] ENERGY CONSERVATION CONSTRUCTION CODE OF NEW YORK STATE. The 2025 edition of the publication entitled "Energy Conservation Construction Code of New York State," published by the International Code Council, Inc. (publication date July 2025).

[NY] ENERGY STORAGE SYSTEM. One or more devices, assembled together, capable of storing energy in order to supply electrical energy at a future time, not to include a stand-alone 12-volt car battery or an electric motor vehicle.

EQUIPMENT OR FIXTURE. Any plumbing, heating, electrical, ventilating, air conditioning, refrigerating and fire protection equipment; and elevators, dumbwaiters, escalators, boilers, pressure vessels and other mechanical facilities; or installations that are related to building services. Equipment or fixture shall not include manufacturing, production or process equipment, but shall include connections from building service to process equipment.

[NY] EXISTING BUILDING. A *building* that is legally occupied and/or for which a certificate of occupancy authorizing its use(s) has been issued, without regard to the date on which such legal occupancy began or the date on which such certificate of occupancy was issued.

[NY] EXISTING STRUCTURE. A structure that is legally occupied and/or for which a certificate of occupancy authorizing its use(s) has been issued, without regard to the date on which such legal occupancy began or the date on which such certificate of occupancy was issued.

[BF] EXTERIOR WALL COVERING. A material or assembly of materials applied on the exterior side of exterior walls for the purpose of providing a weather-resisting barrier, insulation or for aesthetics, including but not limited to, veneers, siding, exterior insulation and finish systems, architectural trim and embellishments, such as cornices, soffits, facias, gutters and leaders.

[BF] EXTERIOR WALL ENVELOPE. A system or assembly of exterior wall components, including exterior wall finish materials, that provides protection of the building structural members, including framing and sheathing materials, and conditioned interior space from the detrimental effects of the exterior environment.

[A] FACILITY. All or any portion of buildings, structures, site improvements, elements and pedestrian or vehicular routes located on a site.

[NY] FIRE CODE OF NEW YORK STATE. The 2025 edition of the publication entitled "Fire Code of New York State," published by the International Code Council, Inc. (publication date July 2025).

[NY] FLOOD HAZARD AREA. The greater of the following two areas:

1. The area within a flood plain subject to a 0.2-percent or greater chance of flooding in any year.
2. The area designated as a *flood hazard area* on a community's flood hazard map, or otherwise legally designated.

[NY] FUEL GAS CODE OF NEW YORK STATE. The 2025 edition of the publication entitled "Fuel Gas Code of New York State," published by the International Code Council, Inc. (publication date July 2025).

[NY] HISTORIC BUILDING. An existing building that is any of the following:

1. Listed, or certified as eligible for listing, in the National Register of Historic Places or in the New York State Register of Historic Places.
2. Designated as historic under an applicable state or local law.
3. Certified as a contributing resource within a National Register-listed, State Register-listed, or locally designated historic district.

[NY] INTERNATIONAL SYMBOL OF ACCESSIBILITY. A sign or symbol that conforms to the accessibility symbol identified in the "Official Compilation of Codes Rules and Regulations of the State of New York," 19 NYCRR Part 300, "Universal Symbol of Access."

[A] LISTED. Equipment, materials, products or services included in a list published by an organization acceptable to the *code official* and concerned with evaluation of products or services that maintains periodic inspection of production of *listed* equipment or materials or periodic evaluation of services and whose listing states either that the equipment, material, product or service meets identified standards or has been tested and found suitable for a specified purpose. Terms that are used to identify *listed* equipment, products or materials include "listed," "certified," "classified" or other terms as determined appropriate by the listing organization.

[BS] LOWEST FLOOR. The lowest floor of the lowest enclosed area, including basement, but excluding any unfinished or flood-resistant enclosure, usable solely for vehicle parking, building access or limited storage provided that such enclosure is not built so as to render the structure in violation of Section 1612 of the *Building Code of New York State* or Section R322 of the *Residential Code of New York State*, as applicable.

[NY] MECHANICAL CODE OF NEW YORK STATE. The 2025 edition of the publication entitled "Mechanical Code of New York State," published by the International Code Council, Inc. (publication date July 2025).

[BF] NONCOMBUSTIBLE MATERIAL. A material that, under the conditions anticipated, will not ignite or burn when subjected to fire or heat. Materials that pass ASTM E136 are considered noncombustible materials.

[BG] OCCUPIABLE ROOF. An exterior space on a roof that is designed for human occupancy, other than maintenance or repair, and which is equipped with a means of egress system meeting the requirements of this code.

[NY] PART 1202. The regulations set forth in 19 NYCRR Part 1202 ("Uniform Code: Administration and Enforcement in Certain Local Governments"), as currently in effect and as hereafter amended from time to time.

[NY] PART 1203. The regulations set forth in 19 NYCRR Part 1203 ("Uniform Code: Minimum Standards for Administration and Enforcement"), as currently in effect and as hereafter amended from time to time.

[NY] PART 1203—COMPLIANT CODE ENFORCEMENT PROGRAM. A code enforcement program that includes the features required by *Part 1203* and satisfies the requirements of *Part 1203*.

[NY] PART 1204. The regulations set forth in 19 NYCRR Part 1204 ("Uniform Code: Administration and Enforcement by State Agencies"), as currently in effect and as hereafter amended from time to time.

[NY] PART 1205. The regulations set forth in 19 NYCRR Part 1205 ("Uniform Code: Variance Procedures"), as currently in effect and as hereafter amended from time to time.

[A] PEER REVIEW. An independent and objective technical review conducted by an *approved* third party.

[BS] PHOTOVOLTAIC PANEL SYSTEM. A system that incorporates discrete photovoltaic panels, that converts solar radiation into electricity, including rack support systems.

[NY] PLUMBING CODE OF NEW YORK STATE. The 2025 edition of the publication entitled "Plumbing Code of New York State," published by the International Code Council, Inc. (publication date July 2025).

PRIMARY FUNCTION. A *primary function* is a major activity for which the *facility* is intended. Areas that contain a *primary function* include, but are not limited to, the customer services lobby of a bank, the dining area of a cafeteria, the meeting rooms in a conference center, as well as offices and other work areas in which the activities of the public accommodation or other private entity using the *facility* are carried out. Mechanical rooms, boiler rooms, supply storage rooms, employee lounges or locker rooms, janitorial closets, entrances, corridors and restrooms are not areas containing a *primary function*.

[NY] PROPERTY MAINTENANCE CODE OF NEW YORK STATE. The 2025 edition of the publication entitled "Property Maintenance Code of New York State," published by the International Code Council, Inc. (publication date July 2025).

[NY] RECONFIGURATION OF SPACE. The act of rearranging or changing the layout, arrangement, or design of a space. This includes, but is not limited to: the installation or removal of walls, partitions, or any other division of space, or a change in the positions or arrangement of objects, furniture, or components within a space.

[A] REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE. A registered design professional engaged by the owner or the owner's authorized agent to review and coordinate certain aspects of the project, as determined by the *code official*, for compatibility with the design of the building or structure, including submittal documents prepared by others, *deferred submittal* documents and phased submittal documents.

[A] RELOCATABLE BUILDING. A partially or completely assembled building constructed and designed to be reused multiple times and transported to different building sites.

[A] REPAIR. The reconstruction, replacement or renewal of any part of an *existing building* for the purpose of its maintenance or to correct damage.

[BS] REROOFING. The process of recovering or replacing an existing roof covering. See "*Roof recover*" and "*Roof replacement*."

[NY] RESIDENTIAL CODE OF NEW YORK STATE. The 2025 edition of the publication entitled "Residential Code of New York State," published by the International Code Council, Inc. (publication date July 2025).

[BS] RISK CATEGORY. A categorization of buildings and other structures for determination of flood, wind, snow, ice and earthquake loads based on the risk associated with unacceptable performance, as provided in Section 1604.5 of the *Building Code of New York State*.

[BS] ROOF COATING. A fluid-applied adhered coating used for roof maintenance, *roof repair* or as a component of a roof covering system or roof assembly.

[BS] ROOF RECOVER. The process of installing an additional roof covering over a prepared existing roof covering without removing the existing roof covering.

[BS] ROOF REPAIR. Reconstruction or renewal of any part of an existing roof for the purpose of correcting damage or restoring the predamage condition.

[BS] ROOF REPLACEMENT. The process of removing the existing roof covering, repairing any damaged substrate and installing a new roof covering.

[BG] STORM SHELTER. A building, structure or portions thereof, constructed in accordance with ICC 500, designated for use during hurricanes, tornadoes or other severe windstorms.

[BS] SUBSTANTIAL DAMAGE. For the purpose of determining compliance with the flood provisions of this code, damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

[BS] SUBSTANTIAL IMPROVEMENT. For the purpose of determining compliance with the flood provisions of this code, any *repair*, *alteration*, *addition* or improvement of a building or structure, the cost of which equals or exceeds 50 percent of the market value of the structure, before the improvement or *repair* is started. If the structure has sustained *substantial damage*, any *repairs* are considered *substantial improvement* regardless of the actual *repair* work performed. The term does not, however, include either of the following:

1. Any project for improvement of a building required to correct existing health, sanitary or safety code violations identified by the *code official* and that is the minimum necessary to ensure safe living conditions.
2. Any *alteration* of a historic structure, provided that the *alteration* will not preclude the structure's continued designation as a historic structure.

[BS] SUBSTANTIAL STRUCTURAL ALTERATION. An *alteration* in which the gravity load-carrying structural elements altered within a 5-year period support more than 30 percent of the total floor and roof area of the building or structure. The areas to be counted toward the 30 percent shall include mezzanines, penthouses, and in-filled courts and shafts tributary to the altered structural elements.

[BS] SUBSTANTIAL STRUCTURAL DAMAGE. A condition where any of the following apply:

1. The vertical elements of the lateral force-resisting system have suffered damage such that the lateral load-carrying capacity of any story in any horizontal direction has been reduced by more than 33 percent from its predamage condition.
2. The capacity of any vertical component carrying gravity load, or any group of such components, that has a tributary area more than 30 percent of the total area of the structure's floor(s) and roof(s) has been reduced more than 20 percent from its predamage condition, and the remaining capacity of such affected elements, with respect to all dead and live loads, is less than 75 percent of that required by the *Building Code of New York State* for new buildings of similar structure, purpose and location.
3. The capacity of any structural component carrying snow load, or any group of such components, that supports more than 30 percent of the roof area of similar construction has been reduced more than 20 percent from its predamage condition, and the remaining capacity with respect to dead, live and snow loads is less than 75 percent of that required by the *Building Code of New York State* for new buildings of similar structure, purpose and location.

For purposes of this definition, work done to implement repairs shall not be considered damage that reduces structural capacity.

TECHNICALLY INFEASIBLE. An *alteration* of a *facility* that has little likelihood of being accomplished because the existing structural conditions require the removal or *alteration* of a load-bearing member that is an essential part of the structural frame, or because other existing physical or site constraints prohibit modification or addition of elements, spaces or features which are in full and strict compliance with the minimum requirements for new construction and which are necessary to provide accessibility.

[NY] TOWNHOUSE. A *building* that contains three or more attached *townhouse units*.

[NY] TOWNHOUSE UNIT. A single-family dwelling unit in a *townhouse* that extends from foundation to roof, that has a yard or public way on not less than two sides, and has a separate means of egress.

[NY] UNIFORM CODE. The New York State Uniform Fire Prevention and Building Code, adopted pursuant to Article 18 of the New York State Executive Law, as currently in effect and as hereafter amended from time to time.

UNSAFE. Buildings, structures or equipment that are unsanitary, or that are deficient due to inadequate means of egress *facilities*, inadequate light and ventilation, or that constitute a fire hazard, or in which the structure or individual structural members meet the definition of *"Dangerous,"* or that are otherwise dangerous to human life or the public welfare, or that involve illegal or improper occupancy or inadequate maintenance shall be deemed *unsafe*. A vacant structure that is not secured against entry shall be deemed *unsafe*.

WORK AREA. That portion or portions of a building consisting of all reconfigured spaces as indicated on the construction documents. Work area excludes other portions of the building where incidental work entailed by the intended work must be performed and portions of the building where work not initially intended by the owner is specifically required by this code.

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CHAPTER

3

PROVISIONS FOR ALL COMPLIANCE METHODS

User notes:

About this chapter: *Chapter 3 explains the three compliance options for alterations and additions available in the code. In addition, this chapter also lays out the methods to be used for seismic design and evaluation throughout this code. Finally, this chapter clarifies that provisions in other NYS Codes related to repairs, alterations, additions, relocation and changes of occupancy must also be addressed unless they conflict with this code. In that case, this code takes precedence.*

SECTION 301—ADMINISTRATION

301.1 Applicability. The *repair*, *alteration*, *change of occupancy*, *addition* or relocation of all *existing buildings* shall comply with Section 301.2, 301.3 or 301.4. The provisions of Sections 302 through 309 shall apply to all *alterations*, *repairs*, *additions*, relocation of structures and *changes of occupancy* regardless of compliance method.

301.1.1 Bleachers, folding and telescopic seating and grandstands. Existing bleachers, folding and telescopic seating and grandstands shall comply with ICC 300.

301.2 Repairs. *Repairs* shall comply with the requirements of Chapter 4.

301.3 Alteration, addition or change of occupancy. The *alteration*, *addition* or *change of occupancy* of all *existing buildings* shall comply with one of the methods listed in Section 301.3.1, 301.3.2 or 301.3.3 as selected by the applicant. Sections 301.3.1 through 301.3.3 shall not be applied in combination with each other.

Exception: Subject to the approval of the *code official*, *alterations* complying with the laws in existence at the time the building or the affected portion of the building was built shall be considered in compliance with the provisions of this code. New structural members added as part of the *alteration* shall comply with the *Building Code of New York State*. This exception shall not apply to the following:

1. *Alterations* for accessibility required by Section 306.
2. *Alterations* that constitute *substantial improvement* in *flood hazard areas*, which shall comply with Sections 503.2, 701.3 or 1303.1.3.
3. Structural provisions of Section 304, Chapter 5 or to the structural provisions of Sections 706, 805 and 906.

301.3.1 Prescriptive compliance method. *Alterations*, *additions* and *changes of occupancy* complying with Chapter 5 of this code in buildings complying with the *Fire Code of New York State* shall be considered in compliance with the provisions of this code.

301.3.2 Work area compliance method. *Alterations*, *additions* and *changes of occupancy* complying with the applicable requirements of Chapters 6 through 12 of this code shall be considered in compliance with the provisions of this code.

301.3.3 Performance compliance method. *Alterations*, *additions* and *changes of occupancy* complying with Chapter 13 of this code shall be considered in compliance with the provisions of this code.

301.4 Relocated buildings. Relocated buildings shall comply with the requirements of Chapter 14.

SECTION 302—GENERAL PROVISIONS

302.1 Dangerous conditions. The *code official* shall have the authority to require the elimination of conditions deemed *dangerous*.

302.2 Additional codes. *Alterations, repairs, additions* and *changes of occupancy* to, or relocation of, *existing buildings* and structures shall comply with the provisions for *alterations, repairs, additions* and *changes of occupancy* or relocation, respectively, in this code and the *Energy Conservation Construction Code of New York State*, *Fire Code of New York State*, *Fuel Gas Code of New York State*, *Mechanical Code of New York State*, *Plumbing Code of New York State*, *Property Maintenance Code of New York State*, *Residential Code of New York State* and NFPA 70. Where provisions of the other codes conflict with provisions of this code, the provisions of this code shall take precedence.

302.2.1 Additional codes in health care. In existing Group I-2 occupancies, ambulatory health care *facilities*, outpatient clinics and hyperbaric *facilities*, *alterations*, *repairs*, *additions* and *changes of occupancy* to, or relocation of, *existing buildings* and structures shall also comply with NFPA 99.

302.3 Existing materials. Materials already in use in a building in compliance with requirements or approvals in effect at the time of their erection or installation shall be permitted to remain in use unless determined by the code official to be *unsafe*.

302.4 New and replacement materials. Except as otherwise required or permitted by this code, materials permitted by the applicable code for new construction shall be used. Like materials shall be permitted for *repairs* and *alterations*, provided that *unsafe* conditions are not created. Hazardous materials shall not be used where the code for new construction would not permit their use in buildings of similar occupancy, purpose and location.

[BS] 302.4.1 New structural members and connections. New structural members and connections shall comply with the detailing provisions of the *Building Code of New York State* for new buildings of similar structure, purpose and location.

Exception: Where alternative design criteria are specifically permitted.

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302.5 Occupancy and use. Where determining the appropriate application of the referenced sections of this code, the occupancy and use of a building shall be determined in accordance with Chapter 3 of the *Building Code of New York State*.

SECTION 303—STORM SHELTERS

[NY] 303.1 General. This section applies to the design and construction of storm shelters for the purpose of providing protection during tornadoes, hurricanes and other severe windstorms. Community storm shelters shall be evaluated and repaired in accordance with this section and ICC 500.

303.1.1 Construction. *Storm shelters* shall be constructed in accordance with Section 423 of the *Building Code of New York State* and ICC 500 and shall be designated as hurricane shelters, tornado shelters or combined hurricane and tornado shelters.

Exception: *Storm shelters* added to critical emergency operations facilities or Group E occupancies are not required to comply with the travel distance in Section 423.4.2 or 423.5.2 of the *Building Code of New York State*.

303.2 Addition to a Group E occupancy. Where an *addition* is added to an existing Group E occupancy located in an area where the shelter design wind speed for tornadoes is 250 mph (402.3 km/h) in accordance with Figure 304.2(1) of ICC 500 and the occupant load in the *addition* is 50 or more, the *addition* shall have a *storm shelter* constructed in accordance with ICC 500.

Exceptions:

1. Group E day care *facilities*.
2. Group E occupancies accessory to places of religious worship.
3. *Additions* meeting the requirements for shelter design in ICC 500.

303.2.1 Design occupant capacity. The required design occupant capacity of the *storm shelter* shall include all buildings on the site, and shall be the total occupant load of the classrooms, vocational rooms and offices in the Group E occupancy.

Exceptions:

1. Where an *addition* is being added on an existing Group E site, and where the *addition* is not of sufficient size to accommodate the required design occupant capacity of the *storm shelter* for all of the buildings on-site, the *storm shelter* shall at a minimum accommodate the required capacity for the *addition*.
2. Where *approved* by the *code official*, the required design occupant capacity of the shelter shall be permitted to be reduced by the design occupant capacity of any existing *storm shelters* on the site.

303.3 Occupancy classification. The occupancy classification for *storm shelters* shall be determined in accordance with Section 423.3 of the *Building Code of New York State*.

SECTION 304—STRUCTURAL DESIGN LOADS AND EVALUATION AND DESIGN PROCEDURES

[BS] 304.1 Live loads. Where an *addition* or *alteration* does not result in increased design live load, existing gravity load-carrying structural elements shall be permitted to be evaluated and designed for live loads *approved* prior to the *addition* or *alteration*. If the *approved* live load is less than that required by Section 1607 of the *Building Code of New York State*, the area designated for the nonconforming live load shall be posted with placards of *approved* design indicating the *approved* live load. Where the *addition* or *alteration* results in increased design live load, the live load required by Section 1607 of the *Building Code of New York State* shall be used.

[BS] 304.2 Snow loads on adjacent buildings. Where an *alteration* or *addition* changes the potential snow drift effects on an adjacent building, the *code official* is authorized to enforce Section 7.12 of ASCE 7.

[BS] 304.3 Seismic evaluation and design procedures. Where required, seismic evaluation or design shall comply with the procedures and criteria in this section, regardless of which compliance method is used. The scope of the required evaluation or design shall be as indicated in applicable provisions of Chapters 4 through 12.

[BS] 304.3.1 Full seismic criteria. Where required, seismic evaluation or design shall comply with one of the following methodologies, which shall not be applied in combination with each other:

1. Section 1613 of the *Building Code of New York State*. Where the existing seismic force-resisting system is a type that can be designated as "Ordinary," values of R, Ω_0 and C_d used for analysis in accordance with Chapter 16 of the *Building Code of New York State* shall be those specified for structural systems classified as "Ordinary" in accordance with Table 12.2-1 of ASCE 7, unless it can be demonstrated that the structural system will provide performance equivalent to that of a "Detailed," "Intermediate" or "Special" system.
2. ASCE 41, using a Tier 3 procedure and both levels of the two-level performance objective in Table 304.3.1 for the applicable *risk category*.

[BS] TABLE 304.3.1—PERFORMANCE OBJECTIVES FOR USE IN ASCE 41 FOR COMPLIANCE WITH FULL SEISMIC CRITERIA		
RISK CATEGORY (Based on BCNYS Table 1604.5)	**STRUCTURAL PERFORMANCE LEVEL FOR USE WITH BSE-1N EARTHQUAKE HAZARD LEVEL**	**STRUCTURAL PERFORMANCE LEVEL FOR USE WITH BSE-2N EARTHQUAKE HAZARD LEVEL**
I	Life Safety (S-3)	Collapse Prevention (S-5)
II	Life Safety (S-3)	Collapse Prevention (S-5)
III	Damage Control (S-2)	Limited Safety (S-4)
IV	Immediate Occupancy (S-1)	Life Safety (S-3)

[BS] 304.3.2 Reduced seismic criteria. Where required, seismic evaluation or design shall comply with one of the following methodologies, which shall not be applied in combination with each other:

1. Section 1613 of the *Building Code of New York State* using 75 percent of the prescribed forces. Values of R, Ω_0 and C_d used for analysis shall be as specified in Section 304.3.1 of this code.
2. Applicable chapters of Appendix A of this code, for structures or portions of structures specified in Items 2.1 through 2.4 subject to the limitations of the respective chapter.
   - 2.1. Chapter A1 for unreinforced masonry bearing wall buildings assigned to *Risk Category* I or II.
   - 2.2. Chapter A2 for the wall anchorage system in reinforced concrete and reinforced masonry wall buildings with flexible diaphragms assigned to *Risk Category* I or II.
   - 2.3. Chapter A3 for cripple walls and sill plate anchorage in residential buildings of light-frame wood construction assigned to *Risk Category* I or II.
   - 2.4. Chapter A4 for soft, weak or open-front wall conditions in multiple-unit residential buildings of wood construction assigned to *Risk Category* I or II.
3. ASCE 41, using the performance objective in Table 304.3.2 for the applicable *risk category*.

[BS] TABLE 304.3.2—PERFORMANCE OBJECTIVES FOR USE IN ASCE 41 FOR COMPLIANCE WITH REDUCED CRITERIA FORCES		
RISK CATEGORY (Based on BCNYS Table 1604.5)	**STRUCTURAL PERFORMANCE LEVEL FOR USE WITH BSE-1E EARTHQUAKE HAZARD LEVEL**	**STRUCTURAL PERFORMANCE LEVEL FOR USE WITH BSE-2E EARTHQUAKE HAZARD LEVEL**
I	Life Safety (S-3). See Note a	Collapse Prevention (S-5)
II	Life Safety (S-3). See Note a	Collapse Prevention (S-5)
III	Damage Control (S-2). See Note a	Limited Safety (S-4). See Note b
IV	Immediate Occupancy (S-1)	Life Safety (S-3). See Note c

a. For Risk Categories I, II and III, the Tier 1 and Tier 2 procedures need not be considered for the BSE-1E earthquake hazard level.
b. For Risk Category III, the Tier 1 screening checklists shall be based on the Collapse Prevention, except that checklist statements using the Quick Check provisions shall be based on *MS*-factors that are the average of the values for Collapse Prevention and Life Safety.
c. For Risk Category IV, the Tier 1 screening checklists shall be based on Collapse Prevention, except that checklist statements using the Quick Check provisions shall be based on *MS*-factors for Life Safety.

SECTION 305—IN-SITU LOAD TESTS

[BS] 305.1 General. Where used, in-situ load tests shall be conducted in accordance with Section 1708 of the *Building Code of New York State*.

SECTION 306—ACCESSIBILITY FOR EXISTING BUILDINGS

[NY] 306.1 Scope. The provisions of Sections 306.1 through 306.7.19 apply to maintenance and *repair*, *change of occupancy*, *additions* and *alterations* to *existing buildings*, including those identified as *historic buildings*.

306.2 General. A *facility* that is constructed or altered to be accessible shall be maintained accessible during occupancy. Required accessible means of egress shall be maintained during construction, demolition, remodeling or *alterations* and *additions* to any occupied building.

Exception: Existing means of egress need not be maintained where *approved* temporary means of egress and accessible means of egress systems and *facilities* are provided.

306.2.1 Prohibited reduction in accessibility. An *alteration* or *addition* that decreases or has the effect of decreasing accessibility of a building, *facility* or element thereof, below the requirements for new construction at the time of the *alteration* or *addition* is prohibited. The number of accessible elements need not exceed that required for new construction at the time of *alteration* or *addition*.

[NY] 306.3 Design. Buildings and *facilities* shall be designed and constructed to be accessible in accordance with this code and the *alteration* and *existing building* provisions in ICC A117.1, as applicable.

Exception: Buildings and *facilities* shall not be required to meet the enhanced classroom acoustics provisions in ICC A117.1.

306.4 Extent of application. An *alteration* of an existing *facility* shall not impose a requirement for greater accessibility than that which would be required for new construction.

306.5 Change of occupancy. Where an existing building undergoes a *change of occupancy* that includes alterations, such alterations shall comply with Section 306.7.

306.6 Additions. Where additions contain dwelling or sleeping units, the accessibility requirements shall apply only to the quantity of the dwelling or sleeping units in the *addition*. Provisions for new construction shall apply to *additions*. An *addition* that affects the accessibility to, or contains an area of, a *primary function* shall comply with the requirements in Section 306.7.1.

306.6.1 Accessible means of egress. Not fewer than one accessible means of egress from the *addition* shall be provided where required by Section 1009.1 of the *Building Code of New York State*. An additional accessible means of egress shall be provided where an additional means of egress is required due to the *addition*. Where an accessible means of egress serving the *addition* is within the *existing building*, the following are required:

1. An accessible route from the *addition* to the *existing building* shall be provided.
2. The accessible means of egress in the *existing building* shall comply with Section 306.7.1.

306.6.1.1 Additions for elevators. Where an *addition* is being constructed exclusively to accommodate the installation of an elevator or elevators to improve accessibility, an accessible means of egress in accordance with Section 1009.1 of the *Building Code of New York State* is not required where all of the following conditions are provided:

1. Two-way communication is provided at all elevator landings that are part of the *addition* in accordance with Section 1009.8 of the *Building Code of New York State*.
2. Each elevator landing is on floor level with access to a horizontal exit or to a stairway with a width of not less than 36 inches (914 mm).
3. The elevator does not serve a required accessible floor or occupied roof more than four stories above or below the level of exit discharge.

[NY] 306.7 Alterations. A *facility* that is altered shall comply with the applicable provisions in Chapter 11 of the *Building Code of New York State,* ICC A117.1 and the provisions of Sections 306.7.1 through 306.7.19, unless *technically infeasible*. Where compliance with this section is *technically infeasible*, the *alteration* shall provide access to the maximum extent technically feasible.

Exception: Buildings and *facilities* shall not be required to meet the enhanced classroom acoustics provisions in ICC A117.1.

306.7.1 Alterations affecting an area containing a primary function. Where an *alteration* affects the accessibility to, or contains an area of, *primary function*, the route to the *primary function* area shall be accessible. Toilet facilities and drinking fountains serving the area of *primary function*, including the route from the area of primary function to these facilities, shall be accessible. Priority shall be given to the improvements affecting the accessible route to the primary function area.

Exceptions:

1. The cumulative costs of providing the accessible route, toilet facilities and drinking fountains are not required to exceed 20 percent of the costs of the *alterations* affecting the area of *primary function*.
2. This provision does not apply to *alterations* limited solely to windows, hardware, operating controls, electrical outlets and signs.
3. This provision does not apply to *alterations* limited solely to mechanical systems, electrical systems, installation or *alteration* of fire protection systems and abatement of hazardous materials.
4. This provision does not apply to *alterations* undertaken for the primary purpose of increasing the accessibility of a *facility*.
5. This provision does not apply to altered areas limited to Type B dwelling and sleeping units.

306.7.2 Accessible means of egress. Accessible means of egress required by Chapter 10 of the *Building Code of New York State* are not required to be added in existing *facilities*.

306.7.3 Alteration of Type A units. The *alteration* to Type A individually owned dwelling units within a Group R-2 occupancy shall be permitted to meet the provision for a Type B dwelling unit.

306.7.4 Type B units. Type B dwelling or sleeping units required by Section 1108 of the *Building Code of New York State* are not required to be provided in *existing buildings* and *facilities* undergoing *alterations* where the *work area* is 50 percent or less of the aggregate area of the building.

306.7.5 Entrances. Where an *alteration* includes *alterations* to an entrance that is not accessible, and the *facility* has an accessible entrance, the altered entrance is not required to be accessible unless required by Section 306.7.1. Signs complying with Section 1112 of the *Building Code of New York State* shall be provided.

306.7.6 Accessible route. Exterior accessible routes, including curb ramps, shall be not less than 36 inches (914 mm) minimum in width.

306.7.7 Elevators. Altered elements of existing elevators shall comply with ASME A17.1. Where the elevator emergency communication system is altered or replaced, that system shall comply with Section 3001.2 of the *Building Code of New York State*. Such elements shall also be altered in elevators programmed to respond to the same hall call control as the altered elevator.

306.7.8 Limited-use/limited-application elevators. Limited-use/limited-application elevators installed in accordance with ASME A17.1 shall be permitted as a component of an accessible route.

306.7.9 Platform lifts. Vertical and inclined platform (wheelchair) lifts installed in accordance with ASME A18.1 shall be permitted as a component of an accessible route.

306.7.10 Stairways and escalators in existing buildings. Where an escalator or stairway is added where none existed previously and major structural modifications are necessary for installation, an accessible route complying with Section 1104.4 of the *Building Code of New York State* is required between levels served by such escalator or stairway.

306.7.11 Determination of number of units. Where Chapter 11 of the *Building Code of New York State* requires Accessible, Type A or Type B units and where such units are being altered or added within an *existing building*, the number of Accessible, Type A and Type B units shall be determined in accordance with Sections 306.7.11.1 through 306.7.11.3.

306.7.11.1 Accessible dwelling or sleeping units. Where Group I-1, I-2, I-3, R-1, R-2 or R-4 dwelling or sleeping units are being altered or added within an *existing building*, the requirements of Section 1108 of the *Building Code of New York State* for Accessible units apply only to the quantity of dwelling or sleeping units being altered or added.

306.7.11.2 Type A dwelling or sleeping units. Where more than 20 Group R-2 dwelling or sleeping units are being altered or added within an *existing building*, the requirements of Section 1108 of the *Building Code of New York State* for Type A units apply only to the quantity of the dwelling or sleeping units being altered or added.

306.7.11.3 Type B dwelling or sleeping units. Where Group I-1, I-2, R-1, R-2, R-3 or R-4 dwelling or sleeping units are being altered or added within an *existing building* and where the *work area* is greater than 50 percent of the aggregate area of the building, the requirements of Section 1108 of the *Building Code of New York State* for Type B units apply only to the quantity of the dwelling or sleeping units being altered or added.

306.7.12 Toilet rooms. Where it is *technically infeasible* to alter existing toilet rooms to be accessible, one accessible single-user toilet room or one accessible family or assisted-use toilet room constructed in accordance with Section 1110.2.1 of the *Building Code of New York State* is permitted. This toilet room shall be located on the same floor and in the same area as the existing toilet rooms. At the inaccessible toilet rooms, directional signs indicating the location of the nearest such toilet room shall be provided. These directional signs shall include the International Symbol of Accessibility, and sign characters shall meet the visual character requirements in accordance with ICC A117.1.

306.7.13 Bathing rooms. Where it is *technically infeasible* to alter existing bathing rooms to be accessible, one accessible single-user bathing room or one accessible family or assisted-use bathing room constructed in accordance with Section 1110.2.1 of the *Building Code of New York State* is permitted. This accessible bathing room shall be located on the same floor and in the same area as the existing bathing rooms. At the inaccessible bathing rooms, directional signs indicating the location of the nearest such bathing room shall be provided. These directional signs shall include the International Symbol of Accessibility, and sign characters shall meet the visual character requirements in accordance with ICC A117.1.

306.7.14 Additional toilet and bathing facilities. In assembly and mercantile occupancies, where additional toilet fixtures are added, not fewer than one accessible family or assisted-use toilet room shall be provided where required by Section 1110.2.1 of the *Building Code of New York State*. In recreational *facilities*, where additional bathing rooms are being added, not fewer than one family or assisted-use bathing room shall be provided where required by Section 1110.2.1 of the *Building Code of New York State*.

306.7.15 Adult changing stations. Where additional toilet facilities are being added, in occupancies where adult changing stations are required by Section 1110.4.1 of the *Building Code of New York State*, not fewer than one accessible family or assisted-use toilet room with an adult changing station shall be provided in accordance with Section 1110.4 of the *Building Code of New York State*. The adult changing station shall be permitted to be located in a family or assisted-use toilet room or bathing room required by Section 306.7.12, 306.7.13 or 306.7.14.

306.7.16 Dressing, fitting and locker rooms. Where it is *technically infeasible* to provide accessible dressing, fitting or locker rooms at the same location as similar types of rooms, one accessible room on the same level shall be provided. Where separate-sex *facilities* are provided, accessible rooms for each sex shall be provided. Separate-sex *facilities* are not required where only unisex rooms are provided.

306.7.17 Amusement rides. Where the structural or operational characteristics of an amusement ride are altered to the extent that the amusement ride's performance differs from that specified by the manufacturer or the original design, the amusement ride shall comply with requirements for new construction in Section 1111.4.8 of the *Building Code of New York State.*

306.7.18 Historic structures. Where compliance with the requirements for accessible routes, entrances or toilet rooms would threaten or destroy the historic significance of the historic structure, as determined by the authority having jurisdiction, the alternative requirements of Sections 306.7.18.1 through 306.7.18.7 for that element shall be permitted.

Exceptions:

1. Accessible means of egress required by Chapter 10 of the *Building Code of New York State* are not required to be provided in historic structures.
2. The altered element or space is not required to be on an accessible route, unless required by Section 306.7.18.1 or 306.7.18.2.

306.7.18.1 Site arrival points. Not fewer than one exterior accessible route, including curb ramps from a site arrival point to an accessible entrance, shall be provided and shall not be less than 36 inches (914 mm) minimum in width.

306.7.18.2 Multiple-level buildings and facilities. An accessible route from an accessible entrance to public spaces on the level of the accessible entrance shall be provided.

306.7.18.3 Entrances. Where an entrance cannot be made accessible in accordance with Section 306.7.5, an accessible entrance that is unlocked while the building is occupied shall be provided; or, a locked accessible entrance with a notification system or remote monitoring shall be provided.

Signs complying with Section 1112 of the *Building Code of New York State* shall be provided at the public entrances and the accessible entrance.

306.7.18.4 Toilet facilities. Where toilet rooms are provided, not fewer than one accessible single-user toilet room or one accessible family or assisted-use toilet room complying with Section 1110.2.1 of the *Building Code of New York State* shall be provided.

306.7.18.5 Bathing facilities. Where bathing rooms are provided, not fewer than one accessible single-user bathing room or one accessible family or assisted-use bathing rooms complying with Section 1110.2.1 of the *Building Code of New York State* shall be provided.

306.7.18.6 Type A units. The *alteration* to Type A individually owned dwelling units within a Group R-2 occupancy shall be permitted to meet the provision for a Type B dwelling unit.

306.7.18.7 Type B units. Type B dwelling or sleeping units required by Section 1108 of the *Building Code of New York State* are not required to be provided in *historic buildings*.

[NY] 306.7.19 Off-street parking lots. Accessible parking complying with Sections 1102.1 and 1106 of the *Building Code of New York State* shall be provided within a six-month period of time when performing any of the following categories of work in an off-street parking lot:

1. Repave, reseal or repaint more than one half of the total number of parking spaces in an off-street parking lot, which contains designated accessible parking spaces;
2. Repave, reseal or repaint more than one half of the total number of designated accessible parking spaces in an off-street parking lot; or
3. Creates designated accessible parking spaces in an off-street parking lot.

[NY] 306.7.19.1 Signage. Accessible parking spaces shall be provided with signage displaying the International Symbol of Accessibility in accordance with Section 1112.1 of the *Building Code of New York State*. Each access aisle shall be provided with signage reading "NO PARKING ANYTIME." Signs shall be permanently installed in accordance with ICC A117.1 and shall not interfere with an accessible route from an access aisle.

SECTION 307—SMOKE ALARMS

307.1 Smoke alarms. Where an *alteration*, *addition*, *change of occupancy* or relocation of a building is made to an *existing building* or structure of a Group R and I-1 occupancy, the *existing building* shall be provided with smoke alarms in accordance with the *Fire Code of New York State* or Section R310 of the *Residential Code of New York State*.

Exception: Work classified as Level 1 *Alterations* in accordance with Chapter 7.

[NY] 307.2 Common spaces. In Groups R-2, R-3, R-4, and I-1, and in dwellings regulated by the *Residential Code of New York State*, single- or multiple-station smoke alarms shall be installed in each common space shared by three or more dwelling units such that an alarm notification is clearly audible in each common space. For the purpose of this provision, common space shall mean any spaces accessible by all residents, including, but not limited to, lobbies, hallways, and stairwells.

SECTION 308—CARBON MONOXIDE DETECTION

[NY] 308.1 Carbon monoxide detection. *Existing buildings* shall be provided with carbon monoxide detection in accordance with Section 915 of the *Fire Code of New York State*.

[NY] 308.1.1 New or relocated fuel-burning appliance. When a new fuel-burning appliance is installed or located in an *addition*; when a new fuel-burning appliance is added to, installed in, or attached to an *existing building*; when an existing fuel-burning appliance is relocated to a different room in an *existing building*, the existing portion of the building shall be provided with additional carbon monoxide detection and notification appliances as necessitated by the new or relocated fuel-burning appliance. The selection, design, and location of the additional detection and notification appliances shall be in accordance with Section 915 of the *Fire Code of New York State*.

Exception: Where carbon monoxide alarms are powered by a 10-year battery, interconnection shall not be required in the following:

1. Existing portions of a building that are provided with additional carbon monoxide detection and notification appliances as required by this section, unless otherwise required by the *Uniform Code*.
2. *Work areas* where an *alteration* does not result in the removal or exposure of interior wall or ceiling finishes that reveal the structure, unless there is an attic, crawl space, basement, or similar space available that could provide access for power and interconnection without the removal of such interior finishes.

3. Buildings without wired power.

[NY] 308.1.2 Motor vehicle related occupancy. When a new motor vehicle related occupancy is added to an *existing building*, the existing portion of the building shall be provided with additional carbon monoxide detection and notification appliances as necessitated by the new motor vehicle related occupancy. The selection, design, and location of the additional detection and notification appliances shall be in accordance with Section 915 of the *Fire Code of New York State*.

Exception: Where carbon monoxide alarms are powered by a 10-year battery, interconnection shall not be required in the following:

1. Existing portions of a building that are provided with additional carbon monoxide detection and notification appliances as required by this section, unless otherwise required by the *Uniform Code*.
2. *Work areas* where an *alteration* does not result in the removal or exposure of interior wall or ceiling finishes that reveal the structure, unless there is an attic, crawl space, basement, or similar space available that could provide access for power and interconnection without the removal of such interior finishes.
3. Buildings without wired power.

SECTION 309—ADDITIONS AND REPLACEMENTS OF EXTERIOR WALL COVERINGS AND EXTERIOR WALL ENVELOPES

309.1 General. The provisions of Section 309 apply to all *alterations*, *repairs*, *additions*, relocations of structures and *changes of occupancy* regardless of compliance method.

309.2 Additions and replacements. Where an *exterior wall covering* or *exterior wall envelope* is added or replaced, the materials and methods used shall comply with the requirements for new construction in Chapter 14 and Chapter 26 of the *Building Code of New York State* if the added or replaced *exterior wall covering* or *exterior wall envelope* involves two or more contiguous stories and comprises more than 15 percent of the total wall area on any side of the building.

309.2.1 Automatic sprinkler systems. Combustible *exterior wall covering* or combustible exterior wall envelopes shall not be added to an existing high-rise building that is not protected throughout with an automatic sprinkler system.

Exceptions:

1. Where such material is located on a single story and is less than 15 percent of the wall area on any side of the building.
2. Water-resistive barriers installed in accordance with Section 1402.6 of the *Building Code of New York State*.

[NY] SECTION 310—ENERGY STORAGE SYSTEMS

[NY] 310.1 Energy storage systems. The installation, operation, maintenance, repair, and retrofitting of energy storage systems shall be in accordance with Section 1207 of the *Fire Code of New York State*.

[NY] SECTION 311—GREASE INTERCEPTORS

[NY] 311.1 Grease interceptors. In addition to the requirements of this code, new and existing grease interceptors shall comply with Section 1003.3.9 of the *Plumbing Code of New York State*.

Exception: Grease interceptors that meet all of the following:

1. Serve individual *dwelling units*.
2. Are not accessible to or open to the public.
3. Are installed in accordance with the manufacturer's installation instructions.
4. Are maintained in accordance with the applicable provisions of this code, the *Property Maintenance Code of New York State*, and the manufacturer's installation instructions.
5. Are regularly serviced and cleaned to prevent the discharge of oil, grease, and other substances harmful or hazardous to the building drainage system, the public sewer, the private sewage disposal system or the sewage treatment plant or processes; and a record of all maintenance, cleaning, and repairs is kept.

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CHAPTER

4 REPAIRS

User notes:

About this chapter: *Chapter 4 provides requirements for repairs of existing buildings. The provisions define conditions under which repairs may be made using materials and methods like those of the original construction or the extent to which repairs must comply with requirements for new buildings.*

SECTION 401—GENERAL

401.1 Scope. *Repairs* shall comply with the requirements of this chapter. *Repairs* to *historic buildings* need only comply with Chapter 12.

401.1.1 Bleachers, folding and telescopic seating and grandstands. *Repairs* to existing bleachers, folding and telescopic seating and grandstands shall comply with ICC 300.

401.2 Compliance. The work shall not make the building less complying than it was before the *repair* was undertaken. Work on nondamaged components that is necessary for the required *repair* of damaged components shall be considered part of the *repair* and shall not be subject to requirements for alterations.

[BS] 401.3 Flood hazard areas. In *flood hazard areas*, *repairs* that constitute *substantial improvement* shall require that the building comply with Section 1612 of the *Building Code of New York State*, or Section R306 of the *Residential Code of New York State*, as applicable.

SECTION 402—BUILDING ELEMENTS AND MATERIALS

402.1 Glazing in hazardous locations. Replacement glazing in hazardous locations shall comply with the safety glazing requirements of the *Building Code of New York State* or *Residential Code of New York State* as applicable.

Exception: Glass block walls, louvered windows and jalousies repaired with like materials.

SECTION 403—FIRE PROTECTION

403.1 General. *Repairs* shall be done in a manner that maintains the level of fire protection provided.

SECTION 404—MEANS OF EGRESS

404.1 General. *Repairs* shall be done in a manner that maintains the level of protection provided for the means of egress.

SECTION 405—STRUCTURAL

[BS] 405.1 General. Structural damage shall be repaired in compliance with this section and Section 401.2.

405.1.1 Structural concrete. *Repair* of structural concrete shall be permitted to comply with ACI 562 Section 1.7, except where Section 405.2.2, 405.2.3 or 405.2.4.1 requires compliance with Section 304.3.

[BS] 405.2 Repairs to damaged buildings. *Repairs* to damaged buildings shall comply with this section.

[BS] 405.2.1 Repairs for less than substantial structural damage. Unless otherwise required by this section, for damage less than *substantial structural damage*, the damaged elements shall be permitted to be restored to their predamage condition.

[BS] 405.2.1.1 Snow damage. Structural components whose damage was caused by or related to snow load effects shall be repaired, replaced or altered to satisfy the requirements of Section 1608 of the *Building Code of New York State*.

[BS] 405.2.2 Disproportionate earthquake damage. A building assigned to Seismic Design Category D, E or F that has sustained *disproportionate earthquake damage* shall be subject to the requirements for buildings with *substantial structural damage* to vertical elements of the lateral force-resisting system.

[BS] 405.2.3 Substantial structural damage to vertical elements of the lateral force-resisting system. A building that has sustained *substantial structural damage* to the vertical elements of its lateral force-resisting system shall be evaluated in accordance with Section 405.2.3.1, and either repaired in accordance with Section 405.2.3.2 or repaired and retrofitted in accordance with Section 405.2.3.3, depending on the results of the evaluation.

Exceptions:

1. Buildings assigned to Seismic Design Category A, B or C whose *substantial structural damage* was not caused by earthquake need not be evaluated or retrofitted for load combinations that include earthquake effects.
2. One- and two-family dwellings need not be evaluated or retrofitted for load combinations that include earthquake effects.

[BS] 405.2.3.1 Evaluation. The building shall be evaluated by a registered design professional, and the evaluation findings shall be submitted to the *code official*. The evaluation shall establish whether the lateral force-resisting system of the damaged building, including its foundation, if repaired to its predamage state, would comply with the provisions of the *Building Code of New York State* for load combinations that include wind effects, and with Section 304.3.2 of this code.

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[BS] 405.2.3.2 Extent of repair for compliant buildings. If the evaluation establishes that the building in its predamage condition complies with the provisions of Section 405.2.3.1, then the damaged elements shall be permitted to be restored to their predamage condition.

[BS] 405.2.3.3 Extent of repair for noncompliant buildings. If the evaluation does not establish that the lateral force-resisting system of the building in its predamage condition complies with the provisions of Section 405.2.3.1, then the lateral force-resisting system, and its foundation, shall be retrofitted to comply with the provisions of this section. The wind loads for the *repair* and *retrofit* shall be those required by the building code in effect at the time of original construction, unless the damage was caused by wind, in which case the wind loads shall be in accordance with the *Building Code of New York State*. The seismic retrofit shall comply with Section 304.3.2 of this code, but the earthquake loads shall not be less than those required by the building code in effect at the time of original construction.

[BS] 405.2.4 Substantial structural damage to gravity load-carrying components. Gravity load-carrying components that have sustained *substantial structural damage* shall be retrofitted to comply with the applicable provisions for dead, live and snow loads in the *Building Code of New York State*. Undamaged gravity load-carrying components, including undamaged foundation components, that receive dead, live or snow loads from retrofitted components shall also be retrofitted if required to comply with these design loads.

[BS] 405.2.4.1 Lateral force-resisting elements. Regardless of the level of damage to vertical elements of the lateral force-resisting system, if *substantial structural damage* to gravity load-carrying components was caused primarily by wind or seismic effects, then the building shall be evaluated in accordance with Section 405.2.3.1 and, if noncompliant, retrofitted in accordance with Section 405.2.3.3.

Exceptions:

1. Buildings assigned to Seismic Design Category A, B or C whose *substantial structural damage* was not caused by earthquake need not be evaluated or retrofitted for load combinations that include earthquake effects.
2. One- and two-family dwellings need not be evaluated or retrofitted for load combinations that include earthquake effects.

[BS] 405.2.5 Substantial structural damage to snow load-carrying components. Where *substantial structural damage* to any snow load-carrying components is caused by or related to snow load effects, any components required to carry snow loads on roof framing of similar construction shall be repaired, replaced or retrofitted to satisfy the requirements of Section 1608 of the *Building Code of New York State*.

[BS] 405.2.6 Flood hazard areas. In *flood hazard* areas, buildings that have sustained *substantial damage* shall be brought into compliance with Section 1612 of the *Building Code of New York State* or Section R306 of the *Residential Code of New York State*, as applicable.

SECTION 406—ELECTRICAL

406.1 General. *Repairs* to existing electrical wiring and equipment shall be in accordance with NFPA 70.

406.1.1 Reconditioned electrical equipment. Reconditioned electrical equipment shall comply with NFPA 70. Electrical equipment prohibited from being reconditioned by the applicable sections of NFPA 70 shall not be reconditioned unless permitted by NFPA 99.

406.1.2 Health care facilities. Portions of electrical systems being repaired in Group I-2, ambulatory care *facilities* and outpatient clinics shall comply with NFPA 99 requirements for *repairs*.

SECTION 407—MECHANICAL

407.1 General. Existing mechanical systems undergoing *repair* shall not make the building less complying than it was before the damaged occurred.

407.2 Mechanical draft systems for manually fired appliances and fireplaces. A mechanical draft system shall be permitted to be used with manually fired appliances and fireplaces where such a system complies with all of the following requirements:

1. The mechanical draft device shall be *listed* and installed in accordance with the manufacturer's installation instructions.
2. A device shall be installed that produces visible and audible warning upon failure of the mechanical draft device or loss of electrical power at any time that the mechanical draft device is turned on. This device shall be equipped with a battery backup if it receives power from the building wiring.
3. A smoke detector shall be installed in the room with the appliance or fireplace. This device shall be equipped with a battery backup if it receives power from the building wiring.

SECTION 408—PLUMBING

408.1 Materials. Plumbing materials and supplies shall not be used for *repairs* that are prohibited in the *Plumbing Code of New York State*.

[NY] 408.2 Water closet replacement. When any water closet is replaced, the replacement water closet shall comply with Section 604.4 of the *Plumbing Code of New York State*.

Exception: Blowout-design water closets [3.5 gallons (13 L) per flushing cycle].

408.3 Health care facilities. Portions of medical gas systems being repaired in Group I-2, ambulatory care *facilities* and outpatient clinics shall comply with NFPA 99 requirements for *repairs*.

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CHAPTER

5 PRESCRIPTIVE COMPLIANCE METHOD

User notes:

About this chapter: *Chapter 5 provides details for the prescriptive compliance method—one of the three main options of compliance available in this code for buildings and structures undergoing alteration, addition or change of occupancy.*

SECTION 501—GENERAL

501.1 Scope. The provisions of this chapter shall control the *alteration, addition* and *change of occupancy* of *existing buildings* and structures, including *historic buildings* and structures as referenced in Section 301.3.1.

501.1.1 Compliance with other methods. *Alterations*, *additions* and *changes of occupancy* to *existing buildings* and structures shall comply with the provisions of this chapter or with one of the methods provided in Section 301.3.

501.2 Fire-resistance ratings. Where *approved* by the *code official*, in buildings where an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2 of the *Building Code of New York State* has been added, and the building is now sprinklered throughout, the required fire-resistance ratings of building elements and materials shall be permitted to meet the requirements of the current building code. The building is required to meet the other applicable requirements of the *Building Code of New York State*.

Plans, investigation and evaluation reports, and other data shall be submitted indicating which building elements and materials the applicant is requesting the *code official* to review and approve for determination of applying the current building code fire-resistance ratings. Any special construction features, including fire-resistance-rated assemblies and smoke-resistive assemblies, conditions of occupancy, means of egress conditions, fire code deficiencies, *approved* modifications or *approved* alternative materials, design and methods of construction, and equipment applying to the building that impact required fire-resistance ratings shall be identified in the evaluation reports submitted.

501.3 Health care facilities. In Group I-2 *facilities*, ambulatory care *facilities* and outpatient clinics, any altered or added portion of an existing electrical or medical gas systems shall be required to meet installation and equipment requirements in NFPA 99.

SECTION 502—ADDITIONS

502.1 General. *Additions* to any building or structure shall comply with the requirements of the *Building Code of New York State* for new construction. *Alterations* to the *existing building* or structure shall be made to ensure that the *existing building* or structure together with the *addition* are not less complying with the provisions of the *Building Code of New York State* than the *existing building* or structure was prior to the *addition* except that the structural elements need only comply with Sections 502.2 through 502.3. An *existing building* together with its *additions* shall comply with the height and area provisions of Chapter 5 of the *Building Code of New York State*. Where a new *occupiable roof* is added to a building or structure, the *occupiable roof* shall comply with the provisions of the *Building Code of New York State*.

Exception: In-filling of floor openings and nonoccupiable appendages such as elevator and exit stairway shafts shall be permitted beyond that permitted by the *Building Code of New York State.*

[BS] 502.1.1 Risk category assignment. Where the *addition* and the *existing building* have different occupancies, the *risk category* of each existing and added occupancy shall be determined in accordance with Section 1604.5.1 of the *Building Code of New York State*. Where application of that section results in a higher *risk category* for the *existing building* compared with the *risk category* for the *existing building* before the *addition*, such a change shall be considered a *change of occupancy* and shall comply with Section 506 of this code. Where application of that section results in a higher *risk category* for the *addition* compared with the *risk category* for the *addition* by itself, the *addition* and any systems in the *existing building* required to serve the *addition* shall comply with the requirements of the *Building Code of New York State* for new construction for the higher *risk category*.

502.1.2 Creation or extension of nonconformity. An *addition* shall not create or extend any nonconformity in the *existing building* to which the *addition* is being made with regard to accessibility, structural strength, supports and attachments for nonstructural components, fire safety, means of egress or the capacity of mechanical, plumbing or electrical systems.

Exception: Nonconforming supports and attachments for nonstructural components that serve the *addition* from within the *existing building* need not be altered to comply with *Building Code of New York State* Section 1613 unless the components are part of the *addition*'s life-safety system or are required to serve an *addition* assigned to *Risk Category* IV.

[BS] 502.2 Flood hazard areas. For buildings and structures in *flood hazard* areas established in Section 1612.3 of the *Building Code of New York State*, or Section R322 of the *Residential Code of New York State*, as applicable, any *addition* that constitutes *substantial improvement* of the *existing structure* shall comply with the flood design requirements for new construction, and all aspects of the *existing structure* shall be brought into compliance with the requirements for new construction for flood design. For new foundations, foundations raised or extended upward, and replacement foundations, the foundations shall be in compliance with the requirements for new construction for flood design.

For buildings and structures in *flood hazard areas* established in Section 1612.3 of the *Building Code of New York State*, or Section R322 of the *Residential Code of New York State*, as applicable, any *additions* that do not constitute *substantial improvement* of the

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existing structure are not required to comply with the flood design requirements for new construction, provided that both of the following apply:

1. The *addition* shall not create or extend a nonconformity of the *existing building* or structure with the flood-resistant construction requirements.
2. The *lowest floor* of the *addition* shall be at or above the lower of the *lowest floor* of the *existing building* or structure or the *lowest floor* elevation required in Section 1612 of the *Building Code of New York State* or Section R306 of the *Residential Code of New York State*, as applicable.

[BS] 502.3 Existing structural elements carrying gravity load. Any existing gravity load-carrying structural element for which an *addition* and its related *alterations* cause an increase in design dead, live or snow load, including snow drift effects, of more than 5 percent shall be replaced or altered as needed to carry the gravity loads required by the *Building Code of New York State* for new structures. Any existing gravity load-carrying structural element whose vertical load-carrying capacity is decreased as part of the *addition* and its related *alterations* shall be considered to be an altered element subject to the requirements of Section 503.3. Any existing element that will form part of the lateral load path for any part of the *addition* shall be considered to be an existing lateral load-carrying structural element subject to the requirements of Section 502.4.

Exception: Buildings of Group R occupancy with not more than five dwelling or sleeping units used solely for residential purposes where the *existing building* and the *addition* together comply with the conventional light-frame construction methods of the *Building Code of New York State* or the provisions of the *Residential Code of New York State*.

[BS] 502.4 Existing structural elements carrying lateral load. Where the *addition* is structurally independent of the *existing structure*, existing lateral load-carrying structural elements shall be permitted to remain unaltered. Where the *addition* is not structurally independent of the *existing structure*, the lateral force-resisting system of the *existing structure* and its *addition* acting together as a single structure shall comply with Section 1609 of the *Building Code of New York State* and with Section 304.3.1 of this code.

Exceptions:

1. Any existing lateral load-carrying structural element whose demand-capacity ratio with the *addition* considered is not more than 10 percent greater than its demand-capacity ratio with the *addition* ignored shall be permitted to remain unaltered. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces in accordance with Sections 1609 and 1613 of the *Building Code of New York State*. For purposes of this exception, comparisons of demand-capacity ratios and calculation of design lateral loads, forces and capacities shall account for the cumulative effects of *additions* and *alterations* since original construction. When calculating demand-capacity ratios for wind, the date of original construction shall be permitted to be taken as the date of completion of a prior *addition*, *alteration* or *repair* in compliance with Section 1609 of the *Building Code of New York State* or the code wind forces in effect at the time. When calculating demand-capacity ratios for earthquake, the date of original construction shall be permitted to be taken as the date of completion of a prior *addition*, *alteration* or *repair* in compliance with Section 304.3.1 or the full seismic forces in effect at the time.
2. Buildings of Group R occupancy with not more than five dwelling or sleeping units used solely for residential purposes where the *existing building* and the *addition* together comply with the conventional light-frame construction methods of the *Building Code of New York State* or the provisions of the *Residential Code of New York State*.

502.5 Smoke barriers in Group I-1, Condition 2. Where an *addition* to an existing Group I-1, Condition 2 building adds sleeping areas that result in more than 50 care recipients on a story, smoke barriers shall be provided to subdivide such story into not fewer than two smoke compartments in accordance with Section 420.6 of the *Building Code of New York State*.

Exception: Where the *existing building* is divided into smoke compartments and the *addition* does not result in any individual smoke compartment exceeding the size and travel distance requirements in Section 420.6 of the *Building Code of New York State*, additional smoke barriers are not required.

[NY] 502.6 Reserved.

SECTION 503—ALTERATIONS

503.1 General. *Alterations* to any building or structure shall comply with the requirements of the *Building Code of New York State* for new construction. *Alterations* shall be such that the *existing building* or structure is not less complying with the provisions of the *Building Code of New York State* than the *existing building* or structure was prior to the *alteration*, except that the structural elements need only comply with Sections 503.2 through 503.12.

Exceptions:

1. An existing stairway shall not be required to comply with the requirements of Section 1011 of the *Building Code of New York State* where the existing space and construction does not allow a reduction in pitch or slope.
2. Handrails otherwise required to comply with Section 1011.11 of the *Building Code of New York State* shall not be required to comply with the requirements of Section 1014.7 of the *Building Code of New York State* regarding full extension of the handrails where such extensions would be hazardous because of plan configuration.
3. Where provided in below-grade transportation stations, existing and new escalators shall be permitted to have a clear width of less than 32 inches (815 mm).

[BS] 503.2 Flood hazard areas. For buildings and structures in *flood hazard areas* established in Section 1612.3 of the *Building Code of New York State*, or Section R306 of the *Residential Code of New York State*, as applicable, any *alteration* that constitutes *substantial*

improvement of the *existing structure* shall comply with the flood design requirements for new construction, and all aspects of the *existing structure* shall be brought into compliance with the requirements for new construction for flood design.

For buildings and structures in *flood hazard areas* established in Section 1612.3 of the *Building Code of New York State*, or Section R306 of the *Residential Code of New York State*, as applicable, any *alterations* that do not constitute *substantial improvement* of the *existing structure* are not required to comply with the flood design requirements for new construction.

[BS] 503.3 Existing structural elements carrying gravity load. Any existing gravity load-carrying structural element for which an *alteration* causes an increase in design dead, live or snow load, including snow drift effects, of more than 5 percent shall be replaced or altered as needed to carry the gravity loads required by the *Building Code of New York State* for new structures. Any existing gravity load-carrying structural element whose gravity load-carrying capacity is decreased as part of the *alteration* shall be shown to have the capacity to resist the applicable design dead, live and snow loads including snow drift effects required by the *Building Code of New York State* for new structures.

Exceptions:

1. Buildings of Group R occupancy with not more than five dwelling or sleeping units used solely for residential purposes where the altered building complies with the conventional light-frame construction methods of the *Building Code of New York State* or the provisions of the *Residential Code of New York State*.
2. Buildings in which the increased dead load is due entirely to the addition of a second layer of roof covering weighing 3 pounds per square foot (0.1437 kN/m^2) or less over an existing single layer of roof covering.

[BS] 503.4 Existing structural elements carrying lateral load. Except as permitted by Section 503.13, where the *alteration* increases design lateral loads, results in a prohibited structural irregularity as defined in ASCE 7, or decreases the capacity of any existing lateral load-carrying structural element, the lateral force-resisting system of the altered building or structure shall meet the requirements of Section 1609 of the *Building Code of New York State* and Section 304.3.2 of this code.

Exceptions:

1. Any existing lateral load-carrying structural element whose demand-capacity ratio with the alteration considered is not more than 10 percent greater than its demand-capacity ratio with the *alteration* ignored shall be permitted to remain unaltered. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces in accordance with Section 1609 of the *Building Code of New York State* and Section 304.3.1 or 304.3.2 of this code. The same methodology shall be used for the altered and unaltered structures. For purposes of this exception, comparisons of demand-capacity ratios and calculation of design lateral loads, forces and capacities shall account for the cumulative effects of additions and alterations since original construction. When calculating demand-capacity ratios for wind, the date of original construction shall be permitted to be taken as the date of completion of a prior *addition*, *alteration* or *repair* in compliance with Section 1609 of the *Building Code of New York State* or the code wind forces in effect at the time. When calculating demand-capacity ratios for earthquake, the date of original construction shall be permitted to be taken as the date of completion of a prior *addition*, *alteration* or *repair* in compliance with Section 304.3.1 or Section 304.3.2, Item 1 or 3, or the full or reduced seismic forces in effect at the time.
2. Buildings in which the increase in the demand-capacity ratio is due entirely to the addition of rooftop-supported mechanical equipment individually having an operating weight less than 400 pounds (181.4 kg) and where the total additional weight of all rooftop equipment placed after initial construction of the building is less than 10 percent of the roof dead load. For purposes of this exception, "roof" shall mean the roof level above a particular story.
3. Increases in the demand-capacity ratio due to lateral loads from seismic forces need not be evaluated for the installation of rooftop *photovoltaic panel systems* where the additional roof dead load due to the system, including ballast where applicable, does not exceed 5 pounds per square foot (psf) (0.2394 kN/m^2) and does not exceed 10 percent of the dead load of the existing roof.

[BS] 503.5 Seismic Design Category F. Where the *work area* exceeds 50 percent of the building area, and where the building is assigned to Seismic Design Category F, the lateral force-resisting system of the altered building shall meet the requirements of Section 1609 of the *Building Code of New York State* and Section 304.3.2 of this code. Supports and attachments for nonstructural components serving any portion of the building with a use included in *Risk Category* IV shall comply with Section 1613 of the *Building Code of New York State* or shall comply with ASCE 41 using an objective of Position Retention nonstructural performance with the BSE-1E earthquake hazard level.

[BS] 503.6 Bracing for unreinforced masonry parapets on reroofing. Where the intended *alteration* requires a permit for *reroofing* and involves removal of roofing materials from more than 25 percent of the roof area of a building assigned to Seismic Design Category D, E or F that has parapets constructed of unreinforced masonry, the work shall comply with Section 304.3.2 by evaluation of the existing condition or by installation of parapet bracing to resist out-of-plane seismic forces.

[BS] 503.7 Anchorage for concrete and reinforced masonry walls. Where the *work area* exceeds 50 percent of the building area, the building is assigned to Seismic Design Category C, D, E or F and the building's structural system includes concrete or reinforced masonry walls with a flexible roof diaphragm, the *alteration* shall comply with Section 304.3.2 by evaluation of the existing condition or by installation of wall anchors at the roof line.

[BS] 503.8 Anchorage for unreinforced masonry walls in major alterations. Where the *work area* exceeds 50 percent of the building area, the building is assigned to Seismic Design Category C, D, E or F and the building's structural system includes unreinforced masonry bearing walls, the *alteration* shall comply with Section 304.3.2 by evaluation of the existing condition or by installation of wall anchors at the floor and roof lines.

[BS] 503.9 Bracing for unreinforced masonry parapets in major alterations. Where the *work area* exceeds 50 percent of the building area, and where the building is assigned to Seismic Design Category C, D, E or F, and the building has parapets constructed of unreinforced masonry, the *alteration* shall comply with Section 304.3.2 by evaluation of the existing condition or by installation of parapet bracing to resist out-of-plane seismic forces.

[BS] 503.10 Anchorage of unreinforced masonry partitions in major alterations. Where the *work area* exceeds 50 percent of the building area, or where the building is assigned to Seismic Design Category C, D, E or F, and the building has unreinforced masonry partitions and nonstructural walls, the *alteration* work shall include evaluation of the existing condition or removal, anchoring or alteration of any such partitions or walls within the *work area* and adjacent to egress paths from the *work area*, to comply with Section 304.3.2.

[BS] 503.11 Substantial structural alteration. Where the *work area* exceeds 50 percent of the building area and where work involves a *substantial structural alteration*, the lateral load-resisting system of the altered building shall satisfy the requirements of Section 1609 of the *Building Code of New York State* and Section 304.3.2 of this code. Where the building is assigned to Seismic Design Category D or F, supports and attachments for nonstructural components required to serve any portion of the building with a use included in *Risk Category* IV shall comply with Section 1613 of the *Building Code of New York State* or shall comply with ASCE 41 using an objective of Position Retention nonstructural performance with the BSE-1E earthquake hazard level.

Exceptions:

1. Buildings of Group R occupancy with not more than five dwelling or sleeping units used solely for residential purposes that are altered based on the conventional light-frame construction methods of the *Building Code of New York State* or in compliance with the provisions of the *Residential Code of New York State*.
2. Where the intended *alteration* involves only the lowest story of a building, structural components of the lateral load-resisting system above that story need not comply with this section.

[BS] 503.12 Roof diaphragms resisting wind loads in high-wind regions. Where the intended *alteration* requires a permit for *reroofing* and involves removal of roofing materials from more than 50 percent of the roof diaphragm of a building or section of a building located where the basic wind speed, *V*, is greater than 130 mph (58 m/s) in accordance with Figure 1609.3(2) of the *Building Code of New York State*, roof diaphragms, connections of the roof diaphragm to roof framing members, and roof-to-wall connections shall be evaluated for the wind loads specified in Section 1609 of the *Building Code of New York State*, including wind uplift. If the diaphragms and connections in their current condition are not capable of resisting 75 percent of those wind loads, they shall be replaced or strengthened in accordance with the loads specified in Section 1609 of the *Building Code of New York State*.

Exception: Buildings that have been demonstrated to comply with the wind load provisions in ASCE 7—88 or later editions.

[BS] 503.13 Voluntary lateral force-resisting system alterations. Structural alterations that are intended exclusively to improve the lateral force-resisting system and are not required by other sections of this code shall not be subject to the structural requirements of Section 503, provided that all of the following apply:

1. With the *alteration* complete, the capacity of existing structural systems to resist forces is not reduced.
2. New structural elements are detailed and connected to existing or new structural elements as required by the selected design criteria.

   Exception: New lateral force-resisting systems designed in accordance with the *Building Code of New York State* are permitted to be of a type designated as "Ordinary" or "Intermediate" where ASCE 7 Table 12.2-1 states these types of systems are not permitted.
3. Supports and attachments for nonstructural elements removed and reinstalled to facilitate the work comply with the *Building Code of New York State* for new construction.
4. The *alterations* do not create a structural irregularity as defined in ASCE 7 or make an existing structural irregularity more severe.

   Exception: Condition 4 need not be satisfied where the work complies with Section 304.3.2, Item 3.

503.14 Smoke compartments. In Group I-2 occupancies where the *alteration* is on a story used for sleeping rooms for more than 30 care recipients, the story shall be divided into not less than two compartments by smoke barrier walls in accordance with Section 407.5 of the *Building Code of New York State* as required for new construction.

503.15 Refuge areas. Where *alterations* affect the configuration of an area utilized as a refuge area, the capacity of the refuge area shall not be reduced below the required capacity of the refuge area for horizontal exits in accordance with Section 1026.4 of the *Building Code of New York State*.

Where the horizontal exit also forms a smoke compartment, the capacity of the refuge area for Group I-1, I-2 and I-3 occupancies and ambulatory care *facilities* shall not be reduced below that required in Sections 407.5.3, 408.6.2, 420.6.1 and 422.3.2 of the *Building Code of New York State,* as applicable.

503.16 Conditions for Group I-1 occupancies. Group I-1 occupancies that are being altered and where the *work area* is greater than 50 percent of the aggregate building area shall be classified as Condition 1 or Condition 2 in accordance with Section 308.2 of the *Building Code of New York State*.

503.16.1 Smoke Barriers in Group I-1, Condition 2. In Group I-1, Condition 2 occupancies where the *work area* is on a story used for sleeping rooms for more than 30 care recipients, the story shall be divided into not less than two compartments by smoke barrier walls in accordance with Section 420.6 of the *Building Code of New York State*.

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503.17 Ambulatory care facilities. Where a *work area* exceeds 50 percent of the building area and the *work area* includes an existing *ambulatory care facility*, the following shall be provided:

1. A smoke compartment in accordance with Section 422.3 of the *Building Code of New York State* where the *alteration* results in an *ambulatory care facility* greater than 10,000 square feet on one story.
2. Separation from adjacent spaces in accordance with Section 422.2 of the *Building Code of New York State*, where any such facility has the potential for four or more care recipients are to be incapable of self-preservation at any time.

[NY] 503.18 Reserved.

503.19 Locking arrangements in educational occupancies. In Group E occupancies, Group B educational occupancies and Group I-4 occupancies, egress doors with locking arrangements designed to keep intruders from entering the room shall comply with Section 1010.2.8 of the *Building Code of New York State*.

503.20 Two-way communications systems. Where the *work area* for *alterations* exceeds 50 percent of the building area and the building has elevator service, a two-way communication systems shall be provided where required by Section 1009.8 of the *Building Code of New York State*.

SECTION 504—FIRE ESCAPES

[BE] 504.1 Where permitted. Fire escapes shall be permitted only as provided for in Sections 504.1.1 through 504.1.4.

[BE] 504.1.1 New buildings. Fire escapes shall not constitute any part of the required means of egress in new buildings.

[BE] 504.1.2 Existing fire escapes. Existing fire escapes shall continue to be accepted as a component in the means of egress in *existing buildings* only.

[BE] 504.1.3 New fire escapes. New fire escapes for *existing buildings* shall be permitted only where exterior stairways cannot be utilized because of lot lines limiting stairway size or because of sidewalks, alleys or roads at grade level. New fire escapes shall not incorporate ladders or access by windows.

[BE] 504.1.4 Limitations. Fire escapes shall comply with this section and shall not constitute more than 50 percent of the required number of exits nor more than 50 percent of the required exit capacity.

[BE] 504.2 Location. Where located on the front of the building and where projecting beyond the building line, the lowest landing shall be not less than 7 feet (2134 mm) or more than 12 feet (3658 mm) above grade, and shall be equipped with a counterbalanced stairway to the street. In alleyways and thoroughfares less than 30 feet (9144 mm) wide, the clearance under the lowest landing shall be not less than 12 feet (3658 mm).

[BE] 504.3 Construction. The fire escape shall be designed to support a live load of 100 pounds per square foot (4788 Pa) and shall be constructed of steel or other *approved noncombustible materials*. Fire escapes constructed of wood not less than nominal 2 inches (51 mm) thick are permitted on buildings of Type V construction. Walkways and railings located over or supported by combustible roofs in buildings of Type III and IV construction are permitted to be of wood not less than nominal 2 inches (51 mm) thick.

[BE] 504.4 Dimensions. Stairways shall be not less than 22 inches (559 mm) wide with risers not more than, and treads not less than, 8 inches (203 mm) and landings at the foot of stairways not less than 40 inches (1016 mm) wide by 36 inches (914 mm) long, located not more than 8 inches (203 mm) below the door.

[BE] 504.5 Opening protectives. Doors and windows within 10 feet (3048 mm) of fire escape stairways shall be protected with $^{3}/_{4}$-hour opening protectives.

Exception: Opening protection shall not be required in buildings equipped throughout with an *approved* automatic sprinkler system.

SECTION 505—WINDOWS AND EMERGENCY ESCAPE OPENINGS

505.1 Replacement windows. The installation or replacement of windows shall be as required for new installations.

505.2 Window fall prevention on replacement windows. In Group R-2 or R-3 buildings containing dwelling units, and one- and two-family dwellings and townhouses regulated by the *Residential Code of New York State*, window opening control devices or other window fall prevention devices complying with ASTM F2090 shall be installed where an existing window is replaced and where all of the following apply to the replacement window:

1. The window is operable.
2. One of the following applies:
   - 2.1. The window replacement includes replacement of the sash and frame.
   - 2.2. The window replacement includes the sash only where the existing frame remains.
3. One of the following applies:
   - 3.1. In Group R-2 or R-3 buildings containing dwelling units, the bottom of the clear opening of the window opening is at a height less than 36 inches (915 mm) above the finished floor.
   - 3.2. In one- and two-family dwellings and townhouses regulated by the *Residential Code of New York State*, the bottom of the clear opening of the window opening is at a height less than 24 inches (610 mm) above the finished floor.
4. The window will permit openings that will allow passage of a 4-inch-diameter (102 mm) sphere when the window is in its largest opened position.

5. The vertical distance from the bottom of the clear opening of the window opening to the finished grade or other surface below, on the exterior of the building, is greater than 72 inches (1829 mm).

Exception: Operable windows where the bottom of the clear opening of the window opening is located more than 75 feet (22 860 mm) above the finished grade or other surface below, on the exterior of the room, space or building, and that are provided with window fall prevention devices that comply with ASTM F2006.

505.3 Replacement window emergency escape and rescue openings. Where windows are required to provide *emergency escape and rescue openings* in Group R-2 and R-3 occupancies and one- and two-family dwellings and townhouses regulated by the *Residential Code of New York State,* replacement windows shall be exempt from the requirements of Section 1031.3 of the *Building Code of New York State* and Section 319.2 of the *Residential Code of New York State,* provided that the replacement window meets the following conditions:

1. The replacement window is the manufacturer's largest standard size window that will fit within the existing frame or existing rough opening. The replacement window shall be permitted to be of the same operating style as the existing window or a style that provides for an equal or greater window opening area than the existing window.
2. Where the replacement of the window is part of a *change of occupancy,* it shall comply with Section 1011.5.6.

505.3.1 Control devices. Window opening control devices or fall prevention devices complying with ASTM F2090 shall be permitted for use on windows required to provide *emergency escape and rescue openings*. After operation to release the control device allowing the window to fully open, the control device shall not reduce the net clear opening area of the window unit. *Emergency escape and rescue openings* shall be operational from the inside of the room without the use of keys or tools.

505.4 Bars, grilles, covers or screens. Bars, grilles, covers, screens or similar devices are permitted to be placed over *emergency escape and rescue openings*, bulkhead enclosure or window wells that serve such openings, provided all of the following conditions are met:

1. The minimum net clear opening size complies with the code that was in effect at the time of construction.
2. Such devices shall be releasable or removable from the inside without the use of a key, tool or force greater than that which is required for normal operation of the escape and rescue opening.
3. Where such devices are installed, they shall not reduce the net clear opening of the *emergency escape and rescue openings*.
4. Smoke alarms shall be installed in accordance with Section 907.2.11 of the *Building Code of New York State*.

SECTION 506—CHANGE OF OCCUPANCY

506.1 Compliance. A *change of occupancy* shall not be made in any building unless that building is made to comply with the requirements of the *Building Code of New York State* for the use or occupancy. Changes of occupancy in a building or portion thereof shall be such that the *existing building* is not less complying with the provisions of this code than the *existing building* or structure was prior to the change. Subject to the approval of the *code official*, changes of occupancy shall be permitted without complying with all of the requirements of this code for the new occupancy, provided that the new occupancy is less hazardous, based on life and fire risk, than the existing occupancy.

Exception: The building need not be made to comply with Chapter 16 of the *Building Code of New York State* unless required by Section 506.5.

506.1.1 Change in the character of use. A *change of occupancy* with no *change of occupancy* classification shall not be made to any structure that will subject the structure to any special provisions of the applicable International Codes, without approval of the *code official*. Compliance shall be only as necessary to meet the specific provisions and is not intended to require the entire building be brought into compliance.

506.2 Certificate of occupancy. A certificate of occupancy shall be issued where it has been determined that the requirements for the new occupancy classification have been met.

506.3 Stairways. An existing stairway shall not be required to comply with the requirements of Section 1011 of the *Building Code of New York State* where the existing space and construction does not allow a reduction in pitch or slope.

506.4 Existing emergency escape and rescue openings. Where a *change of occupancy* would require an *emergency escape and rescue opening* in accordance with Section 1031.1 of the *Building Code of New York State*, operable windows serving as the *emergency escape and rescue opening* shall comply with the following:

1. An existing operable window shall provide a minimum net clear opening of 4 square feet (0.38 m^2) with a minimum net clear opening height of 22 inches (559 mm) and a minimum net clear opening width of 20 inches (508 mm).
2. A replacement window where such window complies with both of the following:
    2.1. The replacement window meets the size requirements in Item 1.
    2.2. The replacement window is the manufacturer's largest standard size window that will fit within the existing frame or existing rough opening. The replacement window shall be permitted to be of the same operating style as the existing window or a style that provides for an equal or greater window opening area than the existing window.

[BS] 506.5 Structural. Any building undergoing a *change of occupancy* shall satisfy the requirements of this section.

[BS] 506.5.1 Live loads. Structural elements carrying tributary live loads from an area with a *change of occupancy* shall satisfy the requirements of Section 1607 of the *Building Code of New York State*. Design live loads for areas of new occupancy shall be based

on Section 1607 of the *Building Code of New York State*. Design live loads for other areas shall be permitted to use previously *approved* design live loads.

Exception: Structural elements whose demand-capacity ratio considering the *change of occupancy* is not more than 5 percent greater than the demand-capacity ratio based on previously *approved* live loads need not comply with this section.

[BS] 506.5.2 Snow and wind loads. Where a *change of occupancy* results in a structure being assigned to a higher *risk category*, the structure shall satisfy the requirements of Sections 1608 and 1609 of the *Building Code of New York State* for the new *risk category*.

Exception: Where the area of the new occupancy is less than 10 percent of the building area, compliance with this section is not required. The cumulative effect of occupancy changes over time shall be considered.

[BS] 506.5.3 Seismic loads (seismic force-resisting system). Where a *change of occupancy* results in a building being assigned to a higher *risk category*, or where the change is from a Group S or Group U occupancy to any occupancy other than Group S or Group U, the lateral force-resisting system of the building shall comply with Section 304.3.1 for the new *risk category*. Where a *change of occupancy* results in a building being assigned to *Risk Category* IV and Seismic Design Category D or F, nonstructural components serving any portion of the building changed to *Risk Category* IV shall comply with the requirements of Section 1613 of the *Building Code of New York State* or shall comply with ASCE 41 using an objective of Operational nonstructural performance with the BSE-1N earthquake hazard level.

Exceptions:

1. Where the area of the new occupancy is less than 10 percent of the building area, the occupancy is not changing from a Group S or Group U occupancy, and the new occupancy is not assigned to *Risk Category* IV, compliance with this section is not required. The cumulative effect of occupancy changes over time shall be considered.
2. Where a *change of use* results in a building being reclassified from *Risk Category* I or II to *Risk Category* III and the seismic coefficient, S_{DS}, is less than 0.33, compliance with this section is not required.
3. Unreinforced masonry bearing wall buildings assigned to *Risk Category* III and to Seismic Design Category A or B, shall be permitted to use Appendix Chapter A1 of this code.
4. Where the change is from a Group S or Group U occupancy and there is no change of *risk category*, compliance with Section 304.3.2 shall be permitted.

[BS] 506.5.4 Access to Risk Category IV. Any structure that provides operational access to an adjacent structure assigned to *Risk Category* IV as the result of a *change of occupancy* shall itself comply with Sections 1608 and 1609 of the *Building Code of New York State* and Section 304.3.1 of this code. Where operational access to the *Risk Category* IV structure is less than 10 feet (3048 mm) from either an interior lot line or from another structure, access protection from potential falling debris shall be provided.

[NY] 506.6 Reserved.

SECTION 507—HISTORIC BUILDINGS

507.1 Historic buildings. The provisions of this code that require improvements relative to a building's existing condition or, in the case of *repairs*, that require improvements relative to a building's predamage condition, shall not be mandatory for *historic buildings* unless specifically required by this section.

507.2 Life safety hazards. The provisions of this code shall apply to *historic buildings* judged by the *code official* to constitute a distinct life safety hazard.

[BS] 507.3 Flood hazard areas. Within *flood hazard areas* established in accordance with Section 1612.3 of the *Building Code of New York State*, or Section R306 of the *Residential Code of New York State*, as applicable, where the work proposed constitutes *substantial improvement,* the building shall be brought into compliance with Section 1612 of the *Building Code of New York State*, or Section R306 of the *Residential Code of New York State*, as applicable.

Exception: *Historic buildings* meeting any of the following criteria need not be brought into compliance:

1. Listed or preliminarily determined to be eligible for listing in the National Register of Historic Places.
2. Determined by the Secretary of the US Department of Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined to qualify as an historic district.
3. Designated as historic under a state or local historic preservation program that is approved by the Department of Interior.

[BS] 507.4 Structural. *Historic buildings* shall comply with the applicable structural provisions in this chapter.

Exceptions:

1. The *code official* shall be authorized to accept existing floors and existing live loads and to approve operational controls that limit the live load on any floor.
2. *Repair* of *substantial structural damage* is not required to comply with Sections 405.2.3 and 405.2.4. *Substantial structural damage* shall be repaired in accordance with Section 405.2.1.

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CHAPTER

6 CLASSIFICATION OF WORK

User notes:

About this chapter: *Chapter 6 provides an overview of the Work Area Method available as an option for rehabilitation of a building. The chapter defines the different classifications of alterations and provides general requirements for alterations, change of occupancy, additions and historic buildings. Detailed requirements for all of these are given in Chapters 7 through 12.*

SECTION 601—GENERAL

601.1 Scope. The provisions of this chapter shall be used in conjunction with Chapters 7 through 12 and shall apply to the *alteration*, *addition* and *change of occupancy* of *existing structures*, including historic structures, as referenced in Section 301.3.2. The work performed on an *existing building* shall be classified in accordance with this chapter.

601.1.1 Compliance with other alternatives. *Alterations*, *additions* and *changes of occupancy* to *existing structures* shall comply with the provisions of Chapters 7 through 12 or with one of the alternatives provided in Section 301.3.

601.2 Work area. The *work area*, as defined in Chapter 2, shall be identified on the construction documents.

SECTION 602—ALTERATION—LEVEL 1

602.1 Scope. Level 1 alterations include the removal and replacement or the covering of existing materials, elements, *equipment or fixtures* using new materials, elements, *equipment or fixtures* that serve the same purpose.

602.2 Application. Level 1 *alterations* shall comply with the provisions of Chapter 7.

SECTION 603—ALTERATION—LEVEL 2

603.1 Scope. Level 2 *alterations* include the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment, and shall apply where the w*ork area* is equal to or less than 50 percent of the building area.

Exception: The movement or addition of nonfixed and movable fixtures, cases, racks, counters and partitions not over 5 feet 9 inches (1753 mm) in height shall not be considered a Level 2 *alteration*.

603.2 Application. Level 2 *alterations* shall comply with the provisions of Chapter 7 for Level 1 *alterations* as well as the provisions of Chapter 8.

SECTION 604—ALTERATION—LEVEL 3

604.1 Scope. Level 3 *alterations* apply where the *work area* exceeds 50 percent of the *building area*.

604.2 Application. Level 3 *alterations* shall comply with the provisions of Chapters 7 and 8 for Level 1 and 2 *alterations*, respectively, as well as the provisions of Chapter 9.

SECTION 605—CHANGE OF OCCUPANCY

605.1 Scope. *Change of occupancy* provisions apply where the activity is classified as a *change of occupancy* as defined in Chapter 2.

605.2 Application. *Changes of occupancy* shall comply with the provisions of Chapter 10.

SECTION 606—ADDITIONS

606.1 Scope. Provisions for *additions* shall apply where work is classified as an *addition* as defined in Chapter 2.

606.2 Application. *Additions* to *existing buildings* shall comply with the provisions of Chapter 11.

SECTION 607—HISTORIC BUILDINGS

607.1 Scope. *Historic building* provisions shall apply to buildings classified as historic as defined in Chapter 2.

607.2 Application. Except as specifically provided for in Chapter 12, *historic buildings* shall comply with applicable provisions of this code for the type of work being performed.

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CHAPTER

7 ALTERATIONS—LEVEL 1

User notes:

About this chapter: *Chapter 7 provides the technical requirements for those existing buildings that undergo Level 1 alterations as described in Section 603, which includes replacement or covering of existing materials, elements, equipment or fixtures using new materials for the same purpose. This chapter, similar to other chapters of this code, covers all building-related subjects, such as structural, mechanical, plumbing, electrical and accessibility as well as the fire and life safety issues when the alterations are classified as Level 1. The purpose of this chapter is to provide detailed requirements and provisions to identify the required improvements in the existing building elements, building spaces and building structural system. This chapter is distinguished from Chapters 8 and 9 by involving only replacement of building components with new components. In contrast, Level 2 alterations involve more space reconfiguration, and Level 3 alterations involve more extensive space reconfiguration, exceeding 50 percent of the building area.*

SECTION 701—GENERAL

701.1 Scope. Level 1 *alterations* as described in Section 602 shall comply with the requirements of this chapter. Level 1 *alterations* to *historic buildings* shall comply with this chapter, except as modified in Chapter 12.

701.2 Conformance. An *existing building* or portion thereof shall not be altered such that the building becomes less safe than its existing condition.

Exception: Where the current level of safety or sanitation is proposed to be reduced, the portion altered shall conform to the requirements of the *Building Code of New York State*.

[BS] 701.3 Flood hazard areas. In *flood hazard areas*, *alterations* that constitute *substantial improvement* shall require that the building comply with Section 1612 of the *Building Code of New York State*, or Section R306 of the *Residential Code of New York State*, as applicable.

SECTION 702—BUILDING ELEMENTS AND MATERIALS

702.1 Interior finishes. Newly installed interior wall and ceiling finishes shall comply with Chapter 8 of the *Building Code of New York State*.

702.2 Interior floor finish. New interior floor finish, including new carpeting used as an interior floor finish material, shall comply with Section 804 of the *Building Code of New York State*.

702.3 Interior trim. Newly installed interior trim materials shall comply with Section 806 of the *Building Code of New York State*.

702.4 Window fall prevention. In Group R-2 or R-3 buildings containing dwelling units and one- and two-family dwellings and townhouses regulated by the *Residential Code of New York State*, window opening control devices or other window fall prevention devices complying with ASTM F2090 shall be installed where an existing window is replaced and where all of the following apply to the replacement window:

1. The window is operable.
2. One of the following applies:
   2.1. The window replacement includes replacement of the sash and frame.
   2.2. The window replacement includes the sash only where the existing frame remains.
3. One of the following applies:
   3.1. In Group R-2 or R-3 buildings containing dwelling units, the bottom of the clear opening of the window opening is at a height less than 36 inches (915 mm) above the finished floor.
   3.2. In one- and two-family dwellings and townhouses regulated by the *Residential Code of New York State*, the bottom of the clear opening of the window opening is at a height less than 24 inches (610 mm) above the finished floor.
4. The window will permit openings that will allow passage of a 4-inch-diameter (102 mm) sphere when the window is in its largest opened position.
5. The vertical distance from the bottom of the clear opening of the window opening to the finished grade or other surface below, on the exterior of the building, is greater than 72 inches (1829 mm).

Exception: Operable windows where the bottom of the clear opening of the window opening is located more than 75 feet (22 860 mm) above the finished grade or other surface below, on the exterior of the room, space or building, and that are provided with window fall prevention devices that comply with ASTM F2006.

702.5 Replacement window for emergency escape and rescue openings. Where windows are required to provide *emergency escape and rescue openings* in Group R-2 and R-3 occupancies and one- and two-family dwellings and townhouses regulated by the *Residential Code of New York State*, replacement windows shall be exempt from the requirements of Section 1031.3 of the *Building Code of New York State* and Section R310.2 of the *Residential Code of New York State*, provided that the replacement window meets the following conditions:

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1. The replacement window is the manufacturer's largest standard size window that will fit within the existing frame or existing rough opening. The replacement window shall be permitted to be of the same operating style as the existing window or a style that provides for an equal or greater window opening area than the existing window.
2. Where the replacement window is part of a *change of occupancy* it shall comply with Section 1011.5.6.

702.5.1 Control devices. Window opening control devices or fall prevention devices complying with ASTM F2090 shall be permitted for use on windows required to provide *emergency escape and rescue openings.* After operation to release the control device allowing the window to fully open, the control device shall not reduce the net clear opening area of the window unit. *Emergency escape and rescue openings* shall be operational from the inside of the room without the use of keys or tools.

702.6 Bars, grilles, covers or screens. Bars, grilles, covers, screens or similar devices are permitted to be placed over *emergency escape and rescue openings*, bulkhead enclosure or window wells that serve such openings, provided all of the following conditions are met:

1. The minimum net clear opening size complies with the code that was in effect at the time of construction.
2. Such devices shall be releasable or removable from the inside without the use of a key, tool or force greater than that which is required for normal operation of the escape and rescue opening.
3. Where such devices are installed, they shall not reduce the net clear opening of the *emergency escape and rescue openings*.
4. Smoke alarms shall be installed in accordance with Section 907.2.11 of the *Building Code of New York State*.

702.7 Materials and methods. New work shall comply with the materials and methods requirements in the *Building Code of New York State*, *Energy Conservation Construction Code of New York State*, *Mechanical Code of New York State* and *Plumbing Code of New York State*, as applicable, that specify material standards, detail of installation and connection, joints, penetrations and continuity of any element, component or system in the building.

[FG] 702.7.1 *Fuel Gas Code of New York State*. The following sections of the *Fuel Gas Code of New York State* shall constitute the fuel gas materials and methods requirements for Level 1 *alterations*.

1. Chapter 3, entitled "General Regulations," except Sections 303.7 and 306.
2. Chapter 4, entitled "Gas Piping Installations," except Sections 401.8 and 402.3.
   2.1. Sections 401.8 and 402.3 shall apply where the work being performed increases the load on the system such that the existing pipe does not meet the size required by code. Existing systems that are modified shall not require resizing as long as the load on the system is not increased and the system length is not increased even if the altered system does not meet code minimums.
3. Chapter 5, entitled "Chimneys and Vents."
4. Chapter 6, entitled "Specific Appliances."

SECTION 703—FIRE PROTECTION

703.1 General. *Alterations* shall be done in a manner that maintains the level of fire protection provided.

SECTION 704—MEANS OF EGRESS

704.1 General. *Alterations* shall be done in a manner that maintains the level of protection provided for the means of egress.

704.1.1 Projections in nursing home corridors. In Group I-2, Condition 1 occupancies, where the corridor is at least 96 inches (2438 mm) wide, projections into the corridor width are permitted in accordance with Section 407.4.3 of the *Building Code of New York State*.

704.2 Casework. Addition, alteration or reconfiguration of nonfixed and movable cases, counters and partitions not over 5 feet 9 inches (1753 mm) in height shall maintain the required means of egress path.

704.3 Locking arrangements in educational occupancies. In Group E occupancies, Group B educational occupancies and Group I-4 occupancies, egress doors with locking arrangements designed to keep intruders from entering the room shall comply with Section 1010.2.7 of the *Building Code of New York State*.

SECTION 705—REROOFING

[BS] 705.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15 of the *Building Code of New York State*.

Exceptions:

1. *Roof replacement* or *roof recover* of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of $^1/_4$ unit vertical in 12 units horizontal (2-percent slope) in Section 1507 of the *Building Code of New York State* for roofs that provide positive roof drainage and meet the requirements of Sections 1608.3 and 1611.2 of the *Building Code of New York State*.
2. Recovering or replacing an existing roof covering shall not be required to meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1502 of the *Building Code of New York State* for roofs that provide for positive roof drainage and meet the requirements of Sections 1608.3 and 1611.2 of the *Building Code of New York State*. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with this

code shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1502 of the *Building Code of New York State*.

[BS] 705.2 Roof replacement. *Roof replacement* shall include the removal of all existing layers of roof coverings down to the roof deck.

Exceptions:

1. Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck and the existing sheathing is not water-soaked or deteriorated to the point that it is not adequate as a base for additional roofing, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507 of the *Building Code of New York State* where permitted by the roof-covering manufacturer and new ice-barrier underlayment manufacturer.
2. Where the existing roof includes a self-adhered underlayment and the existing sheathing is not water-soaked or deteriorated to the point that it is not adequate as a base for additional roofing, the existing self-adhered underlayment shall be permitted to remain in place and covered with an underlayment complying with Tables 1507.1.1(1), 1507.1.1(2) and 1507.1.1(3) of the *Building Code of New York State*.
3. Where the existing roof includes one layer of self-adhered underlayment and the existing layer cannot be removed without damaging the roof deck, a second layer of self-adhered underlayment is permitted to be installed over the existing self-adhered underlayment provided all of the following conditions are met:
    - 3.1 It is permitted by the roof-covering manufacturer and self-adhered underlayment manufacturer.
    - 3.2 The existing sheathing is not water-soaked or deteriorated to the point that it is not adequate as a base for additional roofing.
    - 3.3 The second layer of self-adhered underlayment is installed such that buildup of material at walls, valleys, roof edges, end laps and side laps does not exceed two layers.

[BS] 705.3 Roof recover. The installation of a new roof covering over an existing roof covering shall be permitted where any of the following conditions occur:

1. The new roof covering is installed in accordance with the roof covering manufacturer's *approved* instructions.
2. Complete and separate roofing systems, such as standing-seam metal roof panel systems, that are designed to transmit the roof loads directly to the building's structural system and that do not rely on existing roofs and roof coverings for support, shall not require the removal of existing roof coverings.
3. Metal panel, metal shingle and concrete and clay tile roof coverings shall be permitted to be installed over existing wood shake roofs when applied in accordance with Section 705.3.1.
4. The application of a new protective roof coating over an existing protective *roof coating*, a metal roof panel, built-up roof, spray polyurethane foam roofing system, metal roof shingles, mineral-surfaced roll roofing, modified bitumen roofing or thermoset and thermoplastic single-ply roofing shall be permitted without tear off of existing roof coverings.

Exception: A *roof recover* shall not be permitted where any of the following conditions occur:

1. Where the existing roof or roof covering is water-soaked or has deteriorated to the point that the existing roof or roof covering is not adequate as a base for additional roofing.
2. Where the existing roof covering is slate, clay, cement or asbestos-cement tile.
3. Where the existing roof has two or more applications of any type of roof covering.

[BS] 705.3.1 Roof recovering over wood shingles or shakes. Where the application of a new roof covering over wood shingle or shake roofs creates a combustible concealed space, the entire existing surface shall be covered with gypsum panel products, mineral fiber, glass fiber or other *approved* materials securely fastened in place.

[BS] 705.4 Reinstallation of materials. Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Existing vent flashing, metal edgings, drain outlets, collars and metal counterflashings shall not be reinstalled where rusted, damaged or deteriorated. Existing ballast that is damaged, cracked or broken shall not be reinstalled. Existing aggregate surfacing materials from built-up roofs shall not be reinstalled.

[BS] 705.5 Flashings. Flashings shall be reconstructed in accordance with *approved* manufacturer's installation instructions. Metal flashing to which bituminous materials are to be adhered shall be primed prior to installation.

SECTION 706—STRUCTURAL

[BS] 706.1 General. Where *alteration* work includes replacement of equipment that is supported by the building or where a reroofing permit is required, the provisions of this section shall apply.

[BS] 706.2 Addition or replacement of roofing or replacement of equipment. Any existing gravity load-carrying structural element for which an *alteration* causes an increase in design dead, live or snow load, including snow drift effects, of more than 5 percent shall be replaced or altered as needed to carry the gravity loads required by the *Building Code of New York State* for new structures.

Exceptions:

1. Buildings of Group R occupancy with not more than five dwelling or sleeping units used solely for residential purposes where the altered building complies with the conventional light-frame construction methods of the *Building Code of New York State* or the provisions of the *Residential Code of New York State*.
2. Buildings in which the increased dead load is due entirely to the addition of a second layer of roof covering weighing 3 pounds per square foot (0.1437 kN/m^2) or less over an existing single layer of roof covering.

[BS] 706.3 Additional requirements for reroof permits. The requirements of this section shall apply to *alteration* work requiring reroof permits.

[BS] 706.3.1 Bracing for unreinforced masonry bearing wall parapets. Where a permit is issued for *reroofing* for more than 25 percent of the roof area of a building assigned to Seismic Design Category D, E or F that has parapets constructed of unreinforced masonry, the work shall comply with Section 304.3.2 by evaluation of the existing condition or by installation of parapet bracing.

[BS] 706.3.2 Roof diaphragms resisting wind loads in high-wind regions. Where roofing materials are removed from more than 50 percent of the roof diaphragm or section of a building located where the basic wind speed, *V*, is greater than 130 mph (58 m/s), in accordance with Figure 1609.3(2) of the *Building Code of New York State*, roof diaphragms, connections of the roof diaphragm to roof framing members, and roof-to-wall connections shall be evaluated for the wind loads specified in the *Building Code of New York State*, including wind uplift. If the diaphragms and connections in their current condition are not capable of resisting 75 percent of those wind loads, they shall be replaced or strengthened in accordance with the loads specified in the *Building Code of New York State.*

Exception: Buildings that have been demonstrated to comply with the wind load provisions in ASCE 7—88 or later editions.

SECTION 707—ELECTRICAL

707.1 Health care facilities. In Group I-2 facilities, ambulatory care facilities and outpatient clinics, any altered portion of an existing electrical systems shall be required to meet installation and equipment requirements in NFPA 99.

SECTION 708—ENERGY CONSERVATION

708.1 Minimum requirements. Level 1 *alterations* to *existing buildings* or structures do not require the entire building or structure to comply with the energy requirements of the *Energy Conservation Construction Code of New York State* or *Residential Code of New York State*. The *alterations* shall conform to the energy requirements of the *Energy Conservation Construction Code of New York State* as it relates to new construction only.

[NY] SECTION 709—PLUMBING

[NY] 709.1 Water closet replacement. When any water closet is replaced, the replacement water closet shall comply with Section 604.4 of the *Plumbing Code of New York State*.

CHAPTER

8 ALTERATIONS—LEVEL 2

User notes:

About this chapter: *Like Chapter 7, the purpose of this chapter is to provide detailed requirements and provisions to identify the required improvements in the existing building elements, building spaces and building structural system when a building is being altered. This chapter is distinguished from Chapters 7 and 9 by involving space reconfiguration that could be up to and including 50 percent of the area of the building. In contrast, Level 1 alterations (Chapter 7) do not involve space reconfiguration, and Level 3 alterations (Chapter 9) involve extensive space reconfiguration that exceeds 50 percent of the building area. Depending on the nature of alteration work, its location within the building, and whether it encompasses one or more tenants, improvements and upgrades could be required for the open floor penetrations, sprinkler system or the installation of additional means of egress such as stairs or fire escapes.*

SECTION 801—GENERAL

801.1 Scope. Level 2 *alterations* as described in Section 603 shall comply with the requirements of this chapter.

Exception: Buildings in which the reconfiguration is exclusively the result of compliance with the accessibility requirements of Section 306.7.1 shall be permitted to comply with Chapter 7.

801.2 Alteration Level 1 compliance. In addition to the requirements of this chapter, all work shall comply with the requirements of Chapter 7.

801.3 System installations. Requirements related to *work area* are not applicable where the Level 2 *alterations* are limited solely to one or more of the following:

1. Mechanical systems, electrical systems, fire protection systems and abatement of hazardous materials.
2. Windows, hardware, operating controls, electrical outlets and signs.
3. *Alterations* undertaken for the primary purpose of increasing the accessibility of a *facility*.

801.4 Compliance. New construction elements, components, systems and spaces shall comply with the requirements of the *Building Code of New York State*.

Exceptions:

1. Where windows are added they are not required to comply with the light and ventilation requirements of the *Building Code of New York State*.
2. Newly installed electrical equipment shall comply with the requirements of Section 806.
3. The length of dead-end corridors in newly constructed spaces shall only be required to comply with the provisions of Section 804.8.
4. The minimum ceiling height of the newly created habitable and occupiable spaces and corridors shall be 7 feet (2134 mm).
5. Where provided in below-grade transportation stations, existing and new escalators shall be permitted to have a clear width of less than 32 inches (815 mm).
6. New structural members and connections shall be permitted to comply with alternative design criteria in accordance with Section 302.

SECTION 802—BUILDING ELEMENTS AND MATERIALS

802.1 Scope. The requirements of this section are limited to *work areas* in which Level 2 *alterations* are being performed and shall apply beyond the *work area* where specified.

802.2 Vertical openings. Existing vertical openings shall comply with the provisions of Sections 802.2.1, 802.2.2 and 802.2.3.

802.2.1 Existing vertical openings. Existing interior vertical openings connecting two or more floors shall be enclosed with *approved* assemblies having a fire-resistance rating of not less than 1 hour with *approved* opening protectives.

Exceptions:

1. Where vertical opening enclosure is not required by the *Building Code of New York State* or the *Fire Code of New York State*.
2. Interior vertical openings other than stairways may be blocked at the floor and ceiling of the *work area* by installation of not less than 2 inches (51 mm) of solid wood or equivalent construction.
3. The enclosure shall not be required where:
   - 3.1. Connecting the main floor and mezzanines; or
   - 3.2. All of the following conditions are met:
     - 3.2.1. The communicating area has a low-hazard occupancy or has a moderate-hazard occupancy that is protected throughout by an automatic sprinkler system.

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3.2.2. The lowest or next-to-the-lowest level is a street floor.

3.2.3. The entire area is open and unobstructed in a manner such that it is reasonable to assume that a fire in any part of the interconnected spaces will be readily obvious to all of the occupants.

3.2.4. Exit capacity is sufficient to provide egress simultaneously for all occupants of all levels by considering all areas to be a single floor area for the determination of required exit capacity.

3.2.5. Each floor level, considered separately, has not less than one-half of its individual required exit capacity provided by an exit or exits leading directly out of that level without having to traverse another communicating floor level or be exposed to the smoke or fire spreading from another communicating floor level.

4. In Group A occupancies, a minimum 30-minute enclosure shall be provided to protect all vertical openings not exceeding three stories.

5. In Group B occupancies, a minimum 30-minute enclosure shall be provided to protect all vertical openings not exceeding three stories. This enclosure, or the enclosure specified in Section 802.2.1, shall not be required in the following locations:

   5.1. Buildings not exceeding 3,000 square feet (279 m^2) per floor.

   5.2. Buildings protected throughout by an *approved* automatic fire sprinkler system.

6. In Group E occupancies, the enclosure shall not be required for vertical openings not exceeding three stories where the building is protected throughout by an *approved* automatic fire sprinkler system.

7. In Group F occupancies, the enclosure shall not be required in the following locations:

   7.1. Vertical openings not exceeding three stories.

   7.2. Special-purpose occupancies where necessary for manufacturing operations and direct access is provided to not fewer than one protected stairway.

   7.3. Buildings protected throughout by an *approved* automatic sprinkler system.

8. In Group H occupancies, the enclosure shall not be required for vertical openings not exceeding three stories where necessary for manufacturing operations and every floor level has direct access to not fewer than two remote enclosed stairways or other *approved* exits.

9. In Group M occupancies, a minimum 30-minute enclosure shall be provided to protect all vertical openings not exceeding three stories. This enclosure, or the enclosure specified in Section 802.2.1, shall not be required in the following locations:

   9.1. Openings connecting only two floor levels.

   9.2. Occupancies protected throughout by an *approved* automatic sprinkler system.

10. In Group R-1 occupancies, the enclosure shall not be required for vertical openings not exceeding three stories in the following locations:

    10.1. Buildings protected throughout by an *approved* automatic sprinkler system.

    10.2. Buildings with less than 25 dwelling units or sleeping units where every sleeping room above the second floor is provided with direct access to a fire escape or other *approved* second exit by means of an *approved* exterior door or window having a sill height of not greater than 44 inches (1118 mm) and where both of the following conditions are met:

        10.2.1. Any exit access corridor exceeding 8 feet (2438 mm) in length that serves two means of egress, one of which is an unprotected vertical opening, shall have not fewer than one of the means of egress separated from the vertical opening by a 1-hour fire barrier.

        10.2.2. The building is protected throughout by an automatic fire alarm system, installed and supervised in accordance with the *Building Code of New York State*.

11. In Group R-2 occupancies, a minimum 30-minute enclosure shall be provided to protect all vertical openings not exceeding three stories. This enclosure, or the enclosure specified in Section 802.2.1, shall not be required in the following locations:

    11.1. Vertical openings not exceeding two stories with not more than four dwelling units per floor.

    11.2. Buildings protected throughout by an *approved* automatic sprinkler system.

    11.3. Buildings with not more than four dwelling units per floor where every sleeping room above the second floor is provided with direct access to a fire escape or other *approved* second exit by means of an *approved* exterior door or window having a sill height of not greater than 44 inches (1118 mm) and the building is protected throughout by an automatic fire alarm system complying with Section 803.4.

12. One- and two-family dwellings.

13. Group S occupancies where connecting not more than two floor levels or where connecting not more than three floor levels and the structure is equipped throughout with an *approved* automatic sprinkler system.

14. Group S occupancies where vertical opening protection is not required for open parking garages and ramps.

802.2.2 Supplemental shaft and floor opening enclosure requirements. Where the *work area* on any floor exceeds 50 percent of that floor area, the enclosure requirements of Section 802.2 shall apply to vertical openings other than stairways throughout the floor.

Exception: Vertical openings located in tenant spaces that are entirely outside the *work area*.

802.2.3 Supplemental stairway enclosure requirements. Where the *work area* on any floor exceeds 50 percent of that floor area, stairways that are part of the means of egress serving the *work area* shall, at a minimum, be enclosed with smoketight construction on the highest *work area* floor and all floors below.

Exception: Where stairway enclosure is not required by the *Building Code of New York State* or the *Fire Code of New York State*.

802.3 Smoke compartments. In Group I-2 occupancies where the *work area* is on a story used for sleeping rooms for more than 30 care recipients, the story shall be divided into not less than two compartments by smoke barrier walls in accordance with Section 407.5 of the *Building Code of New York State* as required for new construction.

802.4 Interior finish. The interior finish and trim of walls and ceilings in exits and corridors in any *work area* shall comply with the requirements of the *Building Code of New York State*.

Exception: Existing materials that do not comply with the requirements of the *Building Code of New York State* shall be permitted to be treated with an *approved* fire-retardant coating in accordance with the manufacturer's instructions to achieve the required classification. Compliance with this section shall be demonstrated by testing the fire-retardant coating on the same material and achieving the required performance. Where the same material is not available, testing on a similar material shall be permitted.

802.4.1 Supplemental interior finish requirements. Where the *work area* on any floor exceeds 50 percent of the floor area, Section 802.4 shall apply to the interior finish and trim in exits and corridors serving the *work area* throughout the floor.

Exception: Interior finish within tenant spaces that are entirely outside the *work area*.

802.5 Guards. The requirements of Sections 802.5.1 and 802.5.2 shall apply in all *work areas*.

802.5.1 Minimum requirement. Every portion of a floor, such as a balcony or a loading dock, that is more than 30 inches (762 mm) above the floor or grade below and is not provided with guards, or those in which the existing guards are judged to be in danger of collapsing, shall be provided with guards.

802.5.2 Design. Where there are no guards or where existing guards must be replaced, the guards shall be designed and installed in accordance with the *Building Code of New York State*.

802.6 Fire-resistance ratings. Where *approved* by the *code official*, buildings where an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2 of the *Building Code of New York State* has been added, and the building is now sprinklered throughout, the required fire-resistance ratings of building elements and materials shall be permitted to meet the requirements of the current building code. The building is required to meet the other applicable requirements of the *Building Code of New York State*.

Plans, investigation and evaluation reports, and other data shall be submitted indicating which building elements and materials the applicant is requesting the *code official* to review and approve for determination of applying the current building code fire-resistance ratings. Any special construction features, including fire-resistance-rated assemblies and smoke-resistive assemblies, conditions of occupancy, means-of-egress conditions, fire code deficiencies, *approved* modifications or *approved* alternative materials, design and methods of construction, and equipment applying to the building that impact required fire-resistance ratings shall be identified in the evaluation reports submitted.

SECTION 803—FIRE PROTECTION

803.1 Scope. The requirements of this section shall be limited to *work areas* in which Level 2 *alterations* are being performed, and where specified they shall apply throughout the floor on which the *work areas* are located or otherwise beyond the *work area*.

803.1.1 Corridor ratings. Where an *approved* automatic sprinkler system is installed throughout the story, the required fire-resistance rating for any corridor located on the story shall be permitted to be reduced in accordance with the *Building Code of New York State*. In order to be considered for a corridor rating reduction, such system shall provide coverage for the stairway landings serving the floor and the intermediate landings immediately below.

803.2 Automatic sprinkler systems. Automatic sprinkler systems shall be provided in accordance with the requirements of Sections 803.2.1 through 803.2.6. Installation requirements shall be in accordance with the *Building Code of New York State*.

803.2.1 High-rise buildings. In high-rise buildings, *work areas* that have exits or corridors shared by more than one tenant or that have exits or corridors serving an occupant load greater than 30 shall be provided with automatic sprinkler protection in the entire *work area* where the *work area* is located on a floor that has a sufficient sprinkler water supply system from an existing standpipe or a sprinkler riser serving that floor.

803.2.1.1 Supplemental automatic sprinkler system requirements. Where the *work area* on any floor exceeds 50 percent of that floor area, Section 803.2.1 shall apply to the entire floor on which the *work area* is located.

Exception: Occupied tenant spaces that are entirely outside the *work area*.

803.2.2 Groups A, B, E, F-1, H, I-1, I-3, I-4, M, R-1, R-2, R-4, S-1 and S-2. In buildings with occupancies in Groups A, B, E, F-1, H, I-1, I-3, I-4, M, R-1, R-2, R-4, S-1 and S-2, *work areas* that have exits or corridors shared by more than one tenant or that have exits or corridors serving an occupant load greater than 30 shall be provided with automatic sprinkler protection where both of the following conditions occur:

1. The *work area* is required to be provided with automatic sprinkler protection in accordance with the *Building Code of New York State* as applicable to new construction.
2. The *work area* exceeds 50 percent of the floor area.

Exception: If the building does not have an existing water supply present at the floor of the proposed *work area* with sufficient pressure and flow for the design of a fire sprinkler system and without installation of a new fire pump, the *work areas* shall be protected by an automatic smoke detection system throughout all occupiable spaces other than sleeping units or individual dwelling units that activates the occupant notification system in accordance with Sections 907.4, 907.5 and 907.6 of the *Building Code of New York State*.

803.2.2.1 Mixed uses. In *work areas* containing mixed uses, one or more of which requires automatic sprinkler protection in accordance with Section 803.2.2, such protection shall not be required throughout the *work area* provided that the uses requiring such protection are separated from those not requiring protection by fire-resistance-rated construction having a minimum 2-hour rating for Group H and a minimum 1-hour rating for all other occupancy groups.

803.2.3 Group I-2. In Group I-2 occupancies, an automatic sprinkler system installed in accordance with Section 903.3.1.1 of the *Fire Code of New York State* shall be provided in the following:

1. In Group I-2, Condition 1, throughout the *work area*.
2. In Group I-2, Condition 2, throughout the *work area* where the *work area* is 50 percent or less of the smoke compartment.
3. In Group I-2, Condition 2, throughout the smoke compartment in which the work occurs where the *work area* exceeds 50 percent of the smoke compartment.

803.2.4 Windowless stories. Work located in a windowless story, as determined in accordance with the *Building Code of New York State*, shall be sprinklered where the *work area* is required to be sprinklered under the provisions of the *Building Code of New York State* for newly constructed buildings and the building has a sufficient municipal water supply without installation of a new fire pump.

803.2.5 Other required automatic sprinkler systems. In buildings and areas listed in Table 903.2.11.6 of the *Building Code of New York State*, *work areas* that have exits or corridors shared by more than one tenant or that have exits or corridors serving an occupant load greater than 30 shall be provided with an automatic sprinkler system under the following conditions:

1. The *work area* is required to be provided with an automatic sprinkler system in accordance with the *Building Code of New York State* applicable to new construction; and
2. The building has an existing water supply present at the floor of the proposed *work area* with sufficient pressure and flow for the design of an automatic sprinkler system and without installation of a new fire pump.

803.2.6 Supervision. Automatic sprinkler systems required by this section shall be provided with supervision and alarms in accordance with Section 903.4 of the *Building Code of New York State*.

803.3 Standpipes. Where the *work area* includes exits or corridors shared by more than one tenant and is located more than 50 feet (15 240 mm) above or below the lowest level of fire department access, a standpipe system shall be provided. Standpipes shall have an *approved* fire department connection with hose connections at each floor level above or below the lowest level of fire department access. Standpipe systems shall be installed in accordance with the *Building Code of New York State*.

Exceptions:

1. A pump shall not be required provided that the standpipes are capable of accepting delivery by fire department apparatus of not less than 250 gallons per minute (gpm) at 65 pounds per square inch (psi) (946 L/m at 448 KPa) to the topmost floor in buildings equipped throughout with an automatic sprinkler system or not less than 500 gpm at 65 psi (1892 L/m at 448 KPa) to the topmost floor in all other buildings. Where the standpipe terminates below the topmost floor, the standpipe shall be designed to meet (gpm/psi) (L/m/KPa) requirements of this exception for possible future extension of the standpipe.
2. The interconnection of multiple standpipe risers shall not be required.

803.4 Fire alarm and detection. An *approved* fire alarm system shall be installed in accordance with Sections 803.4.1 through 803.4.3. Where automatic sprinkler protection is provided in accordance with Section 803.2 and is connected to the building fire alarm system, automatic heat detection shall not be required.

803.4.1 Occupancy requirements. A fire alarm system shall be installed in accordance with Sections 803.4.1.1 through 803.4.1.6. Existing alarm-notification appliances shall be automatically activated throughout the building. Where the building is not equipped with a fire alarm system, alarm-notification appliances within the *work area* shall be provided and automatically activated.

Exceptions:

1. Occupancies with an existing, previously *approved* fire alarm system.
2. Where selective notification is permitted, alarm-notification appliances shall be automatically activated in the areas selected.

803.4.1.1 Group E. A fire alarm system shall be installed in *work areas* of Group E occupancies as required by Chapter 11 of the *Fire Code of New York State* for Group E occupancies.

803.4.1.2 Group I-1. An automatic fire alarm system shall be installed in *work areas* of Group I-1 *facilities* as required by Chapter 11 of the *Fire Code of New York State* for existing Group I-1 occupancies.

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803.4.1.3 Group I-2. An automatic fire alarm system shall be installed throughout Group I-2 occupancies as required by Chapter 11 of the *Fire Code of New York State*.

803.4.1.4 Group I-3. A fire alarm system shall be installed in *work areas* of Group I-3 occupancies as required by the *Fire Code of New York State*.

803.4.1.5 Group R-1. A fire alarm system shall be installed in Group R-1 occupancies as required by the Chapter 11 of *Fire Code of New York State* for Group R-1 occupancies.

803.4.1.6 Group R-2. A fire alarm system shall be installed in *work areas* of Group R-2 apartment buildings as required by the *Fire Code of New York State* for existing Group R-2 occupancies.

803.4.2 Supplemental fire alarm system requirements. Where the *work area* on any floor exceeds 50 percent of that floor area, Section 803.4.1 shall apply throughout the floor.

Exception: Alarm-initiating and notification appliances shall not be required to be installed in tenant spaces outside of the *work area*.

803.4.3 Installation. Where a fire alarm system is required to be installed in accordance with Sections 803.4.1 or 803.4.2, the fire alarm system shall be installed in accordance with the provisions of this code, Section 907 of the *Building Code of New York State* and NFPA 72.

SECTION 804—MEANS OF EGRESS

804.1 Scope. The requirements of this section shall be limited to *work areas* that include exits or corridors shared by more than one tenant within the *work area* in which Level 2 *alterations* are being performed, and where specified they shall apply throughout the floor on which the *work areas* are located or otherwise beyond the *work area*.

804.2 General. The means of egress shall comply with the requirements of this section.

Exceptions:

1. Where the *work area* and the means of egress serving it complies with NFPA 101.
2. Means of egress complying with the requirements of the building code under which the building was constructed shall be considered to be compliant means of egress if, in the opinion of the *code official*, they do not constitute a distinct hazard to life.

804.3 Group I-2. In Group I-2 occupancies, in areas where corridors are used for movement of care recipients in beds, the clear width of ramps and corridors shall be not less than 48 inches (1219 mm).

804.4 Refuge areas. Where *alterations* affect the configuration of an area utilized as a refuge area, the capacity of the refuge area shall not be reduced below the required capacity of the refuge area for horizontal exits in accordance with Section 1026.4 of the *Building Code of New York State*. Where the horizontal exit also forms a smoke compartment, the capacity of the refuge area for Group I-1, I-2 and I-3 occupancies and ambulatory care *facilities* shall not be reduced below that required in Sections 407.5.3, 408.6.2, 420.6.1 and 422.3.2 of the *Building Code of New York State*, as applicable.

804.5 Number of exits. The number of exits or access to exits shall be in accordance with Sections 804.5.1 through 804.5.3.

804.5.1 Minimum number. Every story utilized for human occupancy on which there is a *work area* that includes exits or corridors shared by more than one tenant within the *work area* shall be provided with the minimum number of exits based on the occupancy and the occupant load in accordance with the *Building Code of New York State*. In addition, the exits shall comply with Sections 804.5.1.1 and 804.5.1.2.

[NY] 804.5.1.1 Single-exit buildings. Only one exit is required from buildings and stories, including *occupiable roofs*, of the following occupancies:

1. In Group A, E, F and U occupancies located on the level of exit discharge, in buildings not more than five stories, when the occupant load of the story is not greater than 50 and the exit access travel distance is not greater than 75 feet (22.86 m).
2. Group B, S-2 or M occupancies located on the level of exit discharge in buildings not more than five stories, provided the required building features in Table 804.3.1.1 (1) shall be provided.
3. Group B, F-2, and S-2 occupancies in buildings not more than two stories that are not greater than 3,500 square feet per floor (326 m^2) when the exit access travel distance is not greater than 75 feet (22.86 m). The minimum fire-resistance rating of the exit enclosure and of the opening protection shall be one hour.
4. Open parking structures where vehicles are mechanically parked.
5. In group B, S-2 or M occupancies in buildings from three stories to five stories, provided the required building features in Table 804.3.1.1(1) shall be provided.
6. In Group R-2 or R-3 buildings not more than five stories, provided the required building features in Table 804.3.1.1(2) shall be provided.
7. In H-4, H-5 and I occupancies and in rooming houses and child care centers located on the level of exit discharge, with a maximum occupant load of 10 and the exit access travel distance not greater than 75 feet (22.86 m).

[NY] TABLE 804.5.1.1(1)—GROUP B, S-2 OR M LOCATED ON THE LEVEL OF EXIT DISCHARGE SINGLE EXIT BUILDING					
REQUIRED BUILDING FEATURES	MAXIMUM NUMBER OF STORIES OR OCCUPIABLE ROOFS ABOVE GRADE PLANE[a]				
	1 and 2		3		4 and 5
	No Sprinklers	Sprinklers	No Sprinklers	Sprinklers	Sprinklers
Permitted Occupancy	B, S2 or M	B, S2 or M	B, S2 or M	B, S2 or M	B, S2 or M
Content restriction limited to storage or retail display of hazardous materials within the building not exceeding 10% of the maximum allowable quantities in Table 307.1(1) of the *Building Code of New York State*	Yes	Yes	Yes	Yes	Yes
Maximum gross floor area per story or occupiable roof (square feet)	3,500	3,500	3,500	3,500	3,500
Exit access travel distance (feet)	50	75	50	75	75
One emergency escape and rescue opening on each floor and accessible to each tenant[d]	Yes	No	Yes	Yes	Yes
Fire resistance rating of shafts and vertical exit enclosures (hours)	1	0.5	1	0.5	2
Fire resistance rating of corridors (hours)[b]	0.5	0	1	0.5	1
Fire protection rating of corridor openings (hours)	0.33	Self-Closing	0.75	0.33	0.75
Vertical exit and hoistway venting at 3.5% of the cross section and activated by a smoke detector, or smoke management by Section 909 of the *Building Code of New York State*	No Sprinklers	No	No Sprinklers	No	Yes
Corridor and exit interior finishes per Sections 803 and 804 of the *Building Code of New York State*	Yes	Yes	Yes	Yes	Yes
Horizontal assemblies between use groups (hours)[b]	0.5	0	0.5	0	1
Fire partitions between tenants (hours)[b]	0.5	0	0.5	0	1
Incidental use areas fire resistance rating enclosures (hours) in Table 509 of the *Building Code of New York State*	1	0.5	2	0.5	2
Fire dampers per Section 717 of the *Building Code of New York State* State for duct and air transfer openings in horizontal assemblies and shaft enclosures which require a fire resistance rating	Yes	No	Yes	No	Yes
Electrical branch circuits meeting NFPA 70 requirements	Yes	Yes	Yes	Yes	Yes
Manual fire alarm system per Section 907 of the *Building Code of New York State*	Yes	Yes	Yes	Yes	Yes
Automatic heat detection system per Section 907 of the *Building Code of New York State* throughout building in spaces which would otherwise be provided with fire sprinklers per NFPA 13	Yes	No	Yes	No	Yes
Automatic smoke detection per Section 907 of the *Building Code of New York State* in shared exit access corridors	No	No	No	No	No
Electrically supervised quick response wet pipe sprinkler system throughout the building per Section 903.3[c] of the *Building Code of New York State*	No	Yes	No	Yes	Yes
Class I Manual — Wet Fire Standpipe System per Section 905 of the *Building Code of New York State*	No	No	No	No	Yes

a. Provided the building has not more than one level below the first story. Not applicable for Type V construction greater than 3 stories in height.
b. Zero (0) fire resistance rating means wall is required to resist the passage of smoke.
c. Dry pipe sprinkler protection with standard response sprinklers is only permitted in unheated spaces subject to freezing temperatures.
d. Where required, an emergency escape and rescue opening shall have the following characteristics: it shall have a minimum net clear opening of 4 square feet with a minimum dimension of 18 inches (457 mm) with bottom of opening no higher than 3 feet 6 inches (1067 mm) nor lower than 18 inches (457 mm) above finished floor in all above grade stories and no higher than 4 feet 6 inches (1372 mm) in a basement.

[NY] TABLE 804.5.1.1(2)—GROUP R-2 OR R-3 SINGLE EXIT BUILDING					
REQUIRED BUILDING FEATURES	MAXIMUM NUMBER OF STORIES OR OCCUPIABLE ROOFS ABOVE GRADE PLANE[a]				
	1 and 2		3		4 and 5
	No Sprinklers	Sprinklers	No Sprinklers	Sprinklers	Sprinklers
Permitted Occupancy	R2 or R3	R2 or R3	R2 or R3	R2 or R3	R2 or R3
Content restriction limited to storage or retail display of hazardous materials within the building not exceeding 10% of the maximum allowable quantities in Table 307.1(1) of the *Building Code of New York State*	Yes	Yes	Yes	Yes	Yes
Maximum gross floor area per story (square feet)	4 Dwelling Units and 3,500	4 Dwelling Units and 3,500	4 Dwelling Units and 3,500	4 Dwelling Units and 3,500	4 Dwelling Units and 3,500
Exit access travel distance (feet)	50	75	50	75	75
One emergency escape and rescue opening on each floor and accessible to each tenant[d]	Yes	No	Yes	Yes	Yes
Fire resistance rating of shafts and vertical exit enclosures (hours)	1	0.5	1	0.5	2
Fire resistance rating of corridors (hours)[b]	0.5	0	1	0.5	1
Fire protection rating of corridor openings (hours)	0.33	Self-Closing	0.75	0.33	0.75
Vertical exit and hoistway venting at 3.5% of the cross section and activated by a smoke detector, or smoke management in accordance with Section 909 of the *Building Code of New York State*	No	No	No	No	Yes
Corridor and exit interior finishes per Sections 803 and 804 of the *Building Code of New York State*	Yes	Yes	Yes	Yes	Yes
Horizontal assemblies between use groups (hours)[b]	0.5	0	0.5	0	1
Fire partitions between tenants (hours)[b]	0.5	0	0.5	0	1
Incidental use areas fire-resistance-rating enclosures (hours) in Table 509 of the *Building Code of New York State*	1	0.5	2	0.5	2
Fire dampers per Section 717 of the *Building Code of New York State* for duct and air transfer openings in horizontal assemblies and shaft enclosures which require a fire resistance rating	Yes	No	Yes	No	Yes
Electrical branch circuits meeting NFPA 70 requirements	Yes	Yes	Yes	Yes	Yes
Manual fire alarm system per Section 907 of the *Building Code of New York State*	Yes	Yes	Yes	Yes	Yes
Automatic heat detection system per Section 907 of the *Building Code of New York State* throughout the building in spaces which would otherwise be provided with fire sprinklers per NFPA 13	Yes	No	Yes	No	No
Single or multiple-station smoke alarms within dwelling units per Section 907 of the *Building Code of New York State*	Yes	Yes	Yes	Yes	Yes
Automatic smoke detection per Section 907 of the *Building Code of New York State* in shared exit access corridors	Yes	No	Yes	No	No
Electrically supervised quick response wet pipe sprinkler system throughout the building per Section 903.3[c] of the *Building Code of New York State*	No[c]	Yes	Type V construction only[c]	Yes	Yes
Class I Manual — Wet Fire Standpipe System per Section 905 of the *Building Code of New York State*	No	No	No	No	Yes

a. Provided the building has not more than one level below the first story. Not applicable for Type V construction greater than 3 stories in height.
b. Zero (0) fire resistance rating means the wall is required to resist the passage of smoke.
c. Quick response sprinkler protection is required in all nonresidential occupancies located below Group R and for all 3 story, Type V buildings. Dry pipe sprinkler protection with standard response sprinklers is only permitted in unheated spaces subject to freezing temperatures.
d. Where required, an emergency escape and rescue opening shall have the following characteristics: it shall have a minimum net clear opening of 4 square feet with a minimum dimension of 18 inches (457 mm) with bottom of opening no higher than 3 feet 6 inches (1067 mm) nor lower than 18 inches (457 mm) above finished floor in all above grade stories and no higher than 4 feet 6 inches (1372 mm) in a basement.

804.5.1.2 Fire escapes required. For other than Group I-2, where more than one exit is required, an existing or newly constructed fire escape complying with Section 804.5.1.2.1 shall be accepted as providing one of the required means of egress.

804.5.1.2.1 Fire escape access and details. Fire escapes shall comply with all of the following requirements:

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1. Occupants shall have unobstructed access to the fire escape without having to pass through a room subject to locking.
2. Access to a new fire escape shall be through a door, except that windows shall be permitted to provide access from single dwelling units or sleeping units in Group R-1, R-2 and I-1 occupancies or to provide access from spaces having a maximum occupant load of 10 in other occupancy classifications.
   2.1. The window shall have a minimum net clear opening of 5.7 square feet (0.53 m^2) or 5 square feet (0.46 m^2) where located at grade.
   2.2. The minimum net clear opening height shall be 24 inches (610 mm) and net clear opening width shall be 20 inches (508 mm).
   2.3. The bottom of the clear opening shall not be greater than 44 inches (1118 mm) above the floor.
   2.4. The operation of the window shall comply with the operational constraints of the *Building Code of New York State*.
3. Newly constructed fire escapes shall be permitted only where exterior stairways cannot be utilized because of lot lines limiting the stairway size or because of the sidewalks, alleys, or roads at grade level.
4. Openings within 10 feet (3048 mm) of fire escape stairways shall be protected by fire assemblies having minimum $^3/_4$-hour fire-resistance ratings.

   Exception: Opening protection shall not be required in buildings equipped throughout with an *approved* automatic sprinkler system.
5. In all buildings of Group E occupancy, up to and including the 12th grade, buildings of Group I occupancy, rooming houses and childcare centers, ladders of any type are prohibited on fire escapes used as a required means of egress.

804.5.1.2.2 Construction. The fire escape shall be designed to support a live load of 100 pounds per square foot (4788 Pa) and shall be constructed of steel or other *approved noncombustible materials*. Fire escapes constructed of wood not less than nominal 2 inches (51 mm) thick are permitted on buildings of Type V construction. Walkways and railings located over or supported by combustible roofs in buildings of Types III and IV construction are permitted to be of wood not less than nominal 2 inches (51 mm) thick.

804.5.1.2.3 Dimensions. Stairways shall be not less than 22 inches (559 mm) wide with risers not more than, and treads not less than, 8 inches (203 mm). Landings at the foot of stairways shall be not less than 40 inches (1016 mm) wide by 36 inches (914 mm) long and located not more than 8 inches (203 mm) below the door.

804.5.2 Mezzanines. Mezzanines in the *work area* and with an occupant load of more than 50 or in which the travel distance to an exit exceeds 75 feet (22 860 mm) shall have access to not fewer than two independent means of egress.

Exception: Two independent means of egress are not required where the travel distance to an exit does not exceed 100 feet (30 480 mm) and the building is protected throughout with an automatic sprinkler system.

804.5.3 Main entrance—Group A. Buildings of Group A with an occupant load of 300 or more shall be provided with a main entrance capable of serving as the main exit with an egress capacity of not less than one-half of the total occupant load. The remaining exits shall be capable of providing one-half of the total required exit capacity.

Exception: Where a main exit is not well defined or where multiple main exits are provided, exits shall be permitted to be distributed around the perimeter of the building provided that the total width of egress is not less than 100 percent of the required width.

804.6 Egress doorways. Egress doorways in any *work area* shall comply with Sections 804.6.1 through 804.6.5.

804.6.1 Two egress doorways required. *Work areas* shall be provided with two egress doorways in accordance with the requirements of Sections 804.6.1.1 and 804.6.1.2.

804.6.1.1 Occupant load and travel distance. In any *work area*, all rooms and spaces having an occupant load greater than 50 or in which the travel distance to an exit exceeds 75 feet (22 860 mm) shall have not fewer than two egress doorways.

Exceptions:

1. Storage rooms having a maximum occupant load of 10.
2. Where the *work area* is served by a single exit in accordance with Section 804.5.1.1.

804.6.1.2 Group I-2. In Group I-2, Condition 2 *work areas* that include altered care suites shall comply with Sections 407.4.4 through 407.4.4.7.2 of the *Building Code of New York State*.

804.6.2 Door swing. In the *work area* and in the egress path from any *work area* to the exit discharge, all egress doors serving an occupant load of 50 or more shall swing in the direction of exit travel.

804.6.2.1 Supplemental requirements for door swing. Where the *work area* exceeds 50 percent of the floor area, door swing shall comply with Section 804.6.2 throughout the floor.

Exception: Means of egress within or serving only a tenant space that is entirely outside the *work area*.

804.6.3 Door closing. In any *work area*, all doors opening onto an exit passageway at grade or an exit stairway shall be self-closing or automatic-closing by *listed* closing devices.

Exceptions:

1. Where exit enclosure is not required by the *Building Code of New York State*.
2. Means of egress within or serving only a tenant space that is entirely outside the *work area*.

804.6.3.1 Supplemental requirements for door closing. Where the *work area* exceeds 50 percent of the floor area, doors shall comply with Section 804.6.3 throughout the exit stairway from the *work area* to, and including, the level of exit discharge.

804.6.4 Panic and fire exit hardware. In any *work area*, and in the egress path from any *work area* to the exit discharge, in buildings or portions thereof of Group A assembly occupancies with an occupant load greater than 100, all required exit doors equipped with latching devices shall be equipped with *approved* panic or fire exit hardware in accordance with Section 1010.2.~~9~~8 of the *Building Code of New York State*.

804.6.4.1 Supplemental requirements for panic hardware. Where the *work area* exceeds 50 percent of the floor area, panic hardware shall comply with Section 804.6.4 throughout the floor.

Exception: Means of egress within a tenant space that is entirely outside the *work area*.

804.6.5 Emergency power source in Group I-3. Power-operated sliding doors or power-operated locks for swinging doors shall be operable by a manual release mechanism at the door. Emergency power shall be provided for the doors and locks in accordance with Section 2702 of the *Building Code of New York State*.

Exceptions:

1. Emergency power is not required in *facilities* with 10 or fewer locks complying with the exception to Section 408.4.1 of the *Building Code of New York State*.
2. Emergency power is not required where remote mechanical operating releases are provided.

804.7 Openings in corridor walls. Openings in corridor walls in any *work area* shall comply with Sections 804.7.1 through 804.7.4.

Exception: Openings in corridors where such corridors are not required to be rated in accordance with the *Building Code of New York State*.

804.7.1 Corridor doors. Corridor doors in the *work area* shall not be constructed of hollow core wood and shall not contain louvers. Dwelling unit or sleeping unit corridor doors in *work areas* in buildings of Groups R-1, R-2 and I-1 shall be not less than $1^3/_8$-inch (35 mm) solid core wood or *approved* equivalent and shall not have any glass panels, other than *approved* wired glass or other *approved* glazing material in metal frames. Dwelling unit or sleeping unit corridor doors in *work areas* in buildings of Groups R-1, R-2 and I-1 shall be equipped with *approved* door closers. Replacement doors shall be $1^3/_4$-inch (44 mm) solid bonded wood core or *approved* equivalent, unless the existing frame will accommodate only a $1^3/_8$-inch (35 mm) door.

Exceptions:

1. Corridor doors within a dwelling unit or sleeping unit.
2. Existing doors meeting the requirements of *Guidelines on Fire Ratings of Archaic Materials and Assemblies* (Resource A) for a rating of 15 minutes or more shall be accepted as meeting the provisions of this requirement.
3. Existing doors in buildings protected throughout with an *approved* automatic sprinkler system shall be required only to resist smoke, be reasonably tight fitting and shall not contain louvers.
4. In group homes with not more than 15 occupants and that are protected with an *approved* automatic detection system, closing devices are not required.
5. Door assemblies having a fire protection rating of not less than 20 minutes.

804.7.2 Transoms. In all buildings of Group I-1, I-2, R-1 and R-2 occupancies, all transoms in corridor walls in *work areas* shall be either glazed with $^1/_4$-inch (6.4 mm) wired glass set in metal frames or other glazing assemblies having a fire protection rating as required for the door and permanently secured in the closed position or sealed with materials consistent with the corridor construction.

804.7.3 Other corridor openings. In any *work area*, unless protected in accordance with Section 716 of the *Building Code of New York State*, any other sash, grille or opening in a corridor, and any window in a corridor not opening to the outside air, shall be sealed with materials consistent with the corridor construction.

804.7.3.1 Supplemental requirements for other corridor opening. Where the *work area* exceeds 50 percent of the floor area, Section 804.7.3 shall be applicable to all corridor windows, grills, sashes and other openings on the floor.

Exception: Means of egress within or serving only a tenant space that is entirely outside the *work area*.

804.7.4 Supplemental requirements for corridor openings. Where the *work area* on any floor exceeds 50 percent of the floor area, the requirements of Sections 804.7.1 through 804.7.3shall apply throughout the floor.

804.8 Dead-end corridors. Dead-end corridors in any *work area* shall not exceed 35 feet (10 670 mm). In Group I-2 occupancies, dead-end corridors shall not exceed 30 feet (9144 mm).

Exceptions:

1. Where dead-end corridors of greater length are permitted by the *Building Code of New York State*.
2. In other than Group A, I-2 and H occupancies, the maximum length of an existing dead-end corridor shall be 50 feet (15 240 mm) in buildings equipped throughout with an automatic fire alarm system installed in accordance with the *Building Code of New York State*.

3. In other than Group A, I-2 and H occupancies, the maximum length of an existing dead-end corridor shall be 70 feet (21 356 mm) in buildings equipped throughout with an automatic sprinkler system installed in accordance with the *Building Code of New York State*.
4. In other than Group A, I-2 and H occupancies, the maximum length of an existing, newly constructed, or extended dead-end corridor shall not exceed 50 feet (15 240 mm) on floors equipped with an automatic sprinkler system installed in accordance with the *Building Code of New York State*.

804.9 Means-of-egress lighting. Means-of-egress lighting shall be in accordance with this section, as applicable.

804.9.1 Artificial lighting required. Means of egress in all *work areas* shall be provided with artificial lighting in accordance with the requirements of the *Building Code of New York State.*

804.9.2 Supplemental requirements for means-of-egress lighting. Where the *work area* on any floor exceeds 50 percent of that floor area, means of egress throughout the floor shall comply with Section 804.9.1.

Exception: Means of egress within or serving only a tenant space that is entirely outside the *work area*.

804.10 Exit signs. Exit signs shall be in accordance with this section, as applicable.

804.10.1 Work areas. Means of egress in all *work areas* shall be provided with exit signs in accordance with the requirements of the *Building Code of New York State*.

804.10.2 Supplemental requirements for exit signs. Where the *work area* on any floor exceeds 50 percent of that floor area, means of egress throughout the floor shall comply with Section 804.10.1.

Exception: Means of egress within a tenant space that is entirely outside the *work area*.

804.11 Stairways. An existing stairway shall not be required to comply with the requirements of Section 1011 of the *Building Code of New York State* where the existing space and construction does not allow a reduction in pitch or slope.

804.12 Escalators. Where provided in below-grade transportation stations, existing and new escalators shall be permitted to have a clear width of less than 32 inches (813 mm).

804.13 Handrails. The requirements of Sections 804.13.1 and 804.13.2 shall apply to handrails from the *work area* floor to, and including, the level of exit discharge.

804.13.1 Minimum requirement. Every required exit stairway that is part of the means of egress for any *work area* and that has three or more risers and is not provided with not fewer than one handrail, or in which the existing handrails are judged to be in danger of collapsing, shall be provided with handrails for the full length of the stairway on not fewer than one side. Exit stairways with a required egress width of more than 66 inches (1676 mm) shall have handrails on both sides.

804.13.2 Design. Handrails required in accordance with Section 804.13.1 shall be designed and installed in accordance with the provisions of the *Building Code of New York State*.

Exception: Handrails otherwise required to comply with Section 1011.11 of the *Building Code of New York State* shall not be required to comply with the requirements of Section 1014.6 of the *Building Code of New York State* regarding full extension of the handrails where such extensions would be hazardous because of plan configuration.

804.14 Guards. The requirements of 804.14.1 and 804.14.2 shall apply to guards from the *work area* floor to, and including, the level of exit discharge but shall be confined to the egress path of any *work area*.

804.14.1 Minimum requirement. Every open portion of a stairway, landing, or balcony that is more than 30 inches (762 mm) above the floor or grade below and is not provided with guards, or those portions in which existing guards are judged to be in danger of collapsing, shall be provided with guards.

804.14.2 Design. Guards required in accordance with Section 804.14.1 shall be designed and installed in accordance with the *Building Code of New York State*.

Exception: In Group I-1 and I-2 facilities, required guards enclosing the *occupiable roof* areas shall be permitted to be greater than 48 inches (1219 mm) above the surface of the *occupiable roof* where the occupants, because of clinical needs, require restraint or containment as part of a function of a psychiatric or cognitive treatment area.

SECTION 805—STRUCTURAL

[BS] 805.1 General. Structural elements and systems within buildings undergoing Level 2 *alterations* shall comply with this section.

[BS] 805.2 Existing structural elements carrying gravity loads. Any existing gravity load-carrying structural element for which an *alteration* causes an increase in design dead, live or snow load, including snow drift effects, of more than 5 percent shall be replaced or altered as needed to carry the gravity loads required by the *Building Code of New York State* for new structures. Any existing gravity load-carrying structural element whose gravity load-carrying capacity is decreased as part of the *alteration* shall be shown to have the capacity to resist the applicable design dead, live and snow loads, including snow drift effects, required by the *Building Code of New York State* for new structures.

Exceptions:

1. Buildings of Group R occupancy with not more than five dwelling or sleeping units used solely for residential purposes where the altered building complies with the conventional light-frame construction methods of the *Building Code of New York State* or the provisions of the *Residential Code of New York State*.

2. Buildings in which the increased dead load is attributable to the addition of a second layer of roof covering weighing 3 pounds per square foot (0.1437 kN/m^2) or less over an existing single layer of roof covering.

[BS] 805.3 Existing structural elements resisting lateral loads. Except as permitted by Section 805.4, where the *alteration* increases design lateral loads, or where the alteration results in prohibited structural irregularity as defined in ASCE 7, or where the *alteration* decreases the capacity of any existing lateral load-carrying structural element, the lateral force-resisting system of the altered building or structure shall meet the requirements of Section 1609 of the *Building Code of New York State* and Section 304.3.2 of this code.

Exceptions:

1. Any existing lateral load-carrying structural element whose demand-capacity ratio with the *alteration* considered is not more than 10 percent greater than its demand-capacity ratio with the *alteration* ignored shall be permitted to remain unaltered. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces in accordance with Section 1609 of the *Building Code of New York State* and Section 304.3.1 or 304.3.2 of this code. The same methodology shall be used for the altered and unaltered structures. For purposes of this exception, comparisons of demand-capacity ratios and calculation of design lateral loads, forces and capacities shall account for the cumulative effects of *additions* and *alterations* since original construction. When calculating demand-capacity ratios for wind, the date of original construction shall be permitted to be taken as the date of completion of a prior *addition*, *alteration* or *repair* in compliance with Section 1609 of the *Building Code of New York State* or the code wind forces in effect at the time. When calculating demand-capacity ratios for earthquake, the date of original construction shall be permitted to be taken as the date of completion of a prior *addition*, *alteration* or *repair* in compliance with Section 304.3.1 or 304.3.2 Item 1 or 3 or the full or reduced seismic forces in effect at the time.
2. Buildings in which the increase in the demand-capacity ratio is due entirely to the addition of rooftop-supported mechanical equipment individually having an operating weight less than 400 pounds (181.4 kg) and where the total additional weight of all rooftop equipment placed after initial construction of the building is less than 10 percent of the roof dead load. For purposes of this exception, “roof” shall mean the roof level above a particular story.
3. Increases in the demand-capacity ratio due to lateral loads from seismic forces need not be evaluated for the installation of rooftop *photovoltaic panel systems* where the additional roof dead load due to the system, including ballast where applicable, does not exceed 5 pounds per square foot (psf) (0.2394 kN/m^2) and does not exceed 10 percent of the dead load of the existing roof.

[BS] 805.4 Voluntary lateral force-resisting system alterations. Structural *alterations* that are intended exclusively to improve the lateral force-resisting system and are not required by other sections of this code shall not be subject to the structural requirements of this chapter or Chapter 7, provided that the following conditions are met:

1. With the *alteration* complete, the capacity of existing structural systems to resist forces is not reduced.
2. New structural elements are detailed and connected to existing or new structural elements as required by the selected design criteria.

   Exception: New lateral force-resisting systems designed in accordance with the *Building Code of New York State* are permitted to be of a type designated as "Ordinary" or "Intermediate" where ASCE 7 Table 12.2-1 states these types of systems are not permitted.
3. Supports and attachments for nonstructural elements removed and reinstalled to facilitate the work comply with the *Building Code of New York State* for new construction.
4. The *alterations* do not create a structural irregularity as defined in ASCE 7 or make an existing structural irregularity more severe.

   Exception: Condition 4 need not be satisfied where the work complies with Section 304.3.2 Item 3.

SECTION 806—ELECTRICAL

806.1 New installations. Newly installed electrical equipment and wiring relating to work done in any *work area* shall comply with all applicable requirements of NFPA 70 except as provided for in Section 806.4.

806.2 Existing installations. Existing wiring in all *work areas* in Group A-1, A-2, A-5, H and I occupancies shall be upgraded to meet the materials and methods requirements of Chapter 7.

806.3 Health care facilities. In Group I-2 *facilities*, ambulatory care *facilities* and outpatient clinics, any added portion of an existing electrical system shall be required to meet installation and equipment requirements in NFPA 99.

806.4 Residential occupancies. In Group R-2, R-3 and R-4 occupancies and buildings regulated by the *Residential Code of New York State*, the requirements of Sections 806.4.1 through 806.4.7 shall be applicable only to *work areas* located within a dwelling unit.

806.4.1 Enclosed areas. Enclosed areas, other than closets, kitchens, basements, garages, hallways, laundry areas, utility areas, storage areas and bathrooms shall have not fewer than two duplex receptacle outlets or one duplex receptacle outlet and one ceiling or wall-type lighting outlet.

806.4.2 Kitchens. Kitchen areas shall have not fewer than two duplex receptacle outlets.

806.4.3 Laundry areas. Laundry areas shall have not fewer than one duplex receptacle outlet located near the laundry equipment and installed on an independent circuit.

806.4.4 Ground fault circuit interruption. Newly installed receptacle outlets shall be provided with ground fault circuit interruption as required by NFPA 70.

806.4.5 Minimum lighting outlets. Not fewer than one lighting outlet shall be provided in every bathroom, hallway, stairway, attached garage and detached garage with electric power, and to illuminate outdoor entrances and exits.

806.4.6 Utility rooms and basements. Not fewer than one lighting outlet shall be provided in utility rooms and basements where such spaces are used for storage or contain equipment requiring service.

806.4.7 Clearance for equipment. Clearance for electrical service equipment shall be provided in accordance with NFPA 70.

SECTION 807—MECHANICAL

807.1 Reconfigured or converted spaces. Reconfigured spaces intended for occupancy and spaces converted to habitable or occupiable space in any *work area* shall be provided with natural or mechanical ventilation in accordance with the *Mechanical Code of New York State*.

Exception: Existing mechanical ventilation systems shall comply with the requirements of Section 807.2.

807.2 Altered existing systems. In mechanically ventilated spaces, existing mechanical ventilation systems that are altered, reconfigured or extended shall provide not less than 5 cubic feet per minute (cfm) (0.0024 m^3/s) per person of outdoor air and not less than 15 cfm (0.0071 m^3/s) of ventilation air per person, or not less than the amount of ventilation air determined by the Indoor Air Quality Procedure of ASHRAE 62.1.

807.3 Local exhaust. Newly introduced devices, equipment or operations that produce airborne particulate matter, odors, fumes, vapor, combustion products, gaseous contaminants, pathogenic and allergenic organisms, and microbial contaminants in such quantities as to affect adversely or impair health or cause discomfort to occupants shall be provided with local exhaust.

SECTION 808—PLUMBING

808.1 Health care facilities. In Group I-2 *facilities*, ambulatory care *facilities* and outpatient clinics, any added portion of an existing medical gas system shall be required to meet installation and equipment requirements in NFPA 99.

SECTION 809—ENERGY CONSERVATION

809.1 Minimum requirements. Level 2 *alterations* to *existing buildings* or structures are permitted without requiring the entire building or structure to comply with the energy requirements of the *Energy Conservation Construction Code of New York State* or *Residential Code of New York State*. The *alterations* shall conform to the energy requirements of the *Energy Conservation Construction Code of New York State* as it relates to new construction only.

CHAPTER

9 ALTERATIONS—LEVEL 3

User notes:

***About this chapter**:* *Chapter 9 provides the technical requirements for those existing buildings that undergo Level 3 alterations. The purpose of this chapter is to provide detailed requirements and provisions to identify the required improvements in the existing building elements, building spaces and building structural system. This chapter is distinguished from Chapters 7 and 8 by involving alterations that cover 50 percent or more of the aggregate area of the building. In contrast, Level 1 alterations do not involve space reconfiguration, and Level 2 alterations involve extensive space reconfiguration that does not exceed 50 percent of the building area. Depending on the nature of alteration work, its location within the building, and whether it encompasses one or more tenants, improvements and upgrades could be required for the open floor penetrations, sprinkler system or the installation of additional means of egress such as stairs or fire escapes. At times and under certain situations, this chapter also is intended to improve the safety of certain building features beyond the work area and in other parts of the building where no alteration work might be taking place.*

SECTION 901—GENERAL

901.1 Scope. Level 3 *alterations* as described in Section 604 shall comply with the requirements of this chapter.

901.2 Compliance. In addition to the provisions of this chapter, work shall comply with all of the requirements of Chapters 7 and 8. The requirements of Sections 802, 803, 804 and 805 shall apply within all *work areas* whether or not they include exits and corridors shared by more than one tenant and regardless of the occupant load.

Exception: Buildings in which the reconfiguration of space affecting exits or shared egress access is exclusively the result of compliance with the accessibility requirements of Section 306.7.1 shall not be required to comply with this chapter.

SECTION 902—SPECIAL USE AND OCCUPANCY

902.1 High-rise buildings. Any building having occupied floors or an *occupiable roof* more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access shall comply with the requirements of Sections 902.1.1 and 902.1.2.

902.1.1 Recirculating air or exhaust systems. Where a floor is served by a recirculating air or exhaust system with a capacity greater than 15,000 cubic feet per minute (701 m^3/s), that system shall be equipped with *approved* smoke and heat detection devices installed in accordance with the *Mechanical Code of New York State*.

902.1.2 Elevators. Where there is an elevator or elevators for public use, not fewer than one elevator serving the *work area* shall comply with this section. Existing elevators with a travel distance of 25 feet (7620 mm) or more above or below the main floor or other level of a building and intended to serve the needs of emergency personnel for fire-fighting or rescue purposes shall be provided with emergency operation in accordance with ASME A17.3. New elevators shall be provided with Phase I emergency recall operation and Phase II emergency in-car operation in accordance with ASME A17.1/CSA B44.1.

902.2 Conditions for I-1 occupancies. Group I-1 occupancies shall be classified as Condition 1 or Condition 2 in accordance with Section 308.2 of the *Building Code of New York State*.

902.2.1 Smoke barriers in Group I-1, Condition 2. In Group I-1, Condition 2 occupancies where the *work area* is on a story used for sleeping rooms for more than 30 care recipients, the story shall be divided into not fewer than two compartments by smoke barrier walls in accordance with Section 420.6 of the *Building Code of New York State*.

902.3 Ambulatory care facilities. Where a Level 3 *work area* includes an existing *ambulatory care facility*, the following shall be provided:

1. A smoke compartment in accordance with Section 422.3 of the *Building Code of New York State*, where the *alteration* results in an *ambulatory care facility* greater than 10,000 square feet on one story.
2. Separation from adjacent spaces in accordance with Section 422.2 of the *Building Code of New York State*, where any such facility has the potential for four or more care recipients incapable of self-preservation at any time.

902.4 Boiler and furnace equipment rooms. Boiler and furnace equipment rooms adjacent to or within Group I-1, I-2, I-4, R-1, R-2 and R-4 occupancies shall be enclosed by 1-hour fire-resistance-rated construction.

Exceptions:

1. Steam boiler equipment operating at pressures of 15 pounds per square inch gauge (psig) (103.4 kPa) or less is not required to be enclosed.
2. Hot water boilers operating at pressures of 170 psig (1171 kPa) or less are not required to be enclosed.
3. Furnace and boiler equipment with 400,000 British thermal units (Btu) (4.22 × 108 J) per hour input rating or less is not required to be enclosed.
4. Furnace rooms protected with an automatic sprinkler system are not required to be enclosed.

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SECTION 903—BUILDING ELEMENTS AND MATERIALS

903.1 Existing shafts and vertical openings. Existing stairways that are part of the means of egress shall be enclosed in accordance with Section 802.2.1 from the highest *work area* floor to, and including, the level of exit discharge and all floors below.

903.2 Fire partitions in Group R-3. Fire separation in Group R-3 occupancies shall be in accordance with Section 903.2.1.

903.2.1 Separation required. Where the *work area* is in any attached dwelling unit in Group R-3 or any multiple single-family dwelling (townhouse), walls separating the dwelling units that are not continuous from the foundation to the underside of the roof sheathing shall be constructed to provide a continuous fire separation using construction materials consistent with the existing wall or complying with the requirements for new structures. Work shall be performed on the side of the dwelling unit wall that is part of the *work area*.

Exception: Where *alterations* or *repairs* do not result in the removal of wall or ceiling finishes exposing the structure, walls are not required to be continuous through concealed floor spaces.

903.3 Interior finish. Interior finish in exits serving the *work area* shall comply with Section 802.4 between the highest floor on which there is a *work area* to the floor of exit discharge.

[NY] 903.4 Reserved.

SECTION 904—FIRE PROTECTION

904.1 Automatic sprinkler systems. An automatic sprinkler system shall be provided in a *work area* where required by Section 803.2 or this section.

904.1.1 High-rise buildings. An automatic sprinkler system shall be provided in *work areas* where the high-rise building has a sufficient municipal water supply for the design and installation of an automatic sprinkler system at the site.

904.1.2 Rubbish and linen chutes. Rubbish and linen chutes located in the *work area* shall be provided with automatic sprinkler system protection or an *approved* automatic fire-extinguishing system where protection of the rubbish and linen chute would be required under the provisions of the *Building Code of New York State* for new construction.

904.1.3 Upholstered furniture or mattresses. *Work areas* shall be provided with an automatic sprinkler system in accordance with the *Building Code of New York State* where any of the following conditions exist:

1. A Group F-1 occupancy used for the manufacture of upholstered furniture or mattresses exceeds 2,500 square feet (232 m^2).
2. A Group M occupancy used for the display and sale of upholstered furniture or mattresses exceeds 5,000 square feet (464 m^2).
3. A Group S-1 occupancy used for the storage of upholstered furniture or mattresses exceeds 2,500 square feet (232 m^2).

904.1.4 Groups A, B, E, F-1, H, I-1, I-3, I-4, M, R-1, R-2, R-4, S-1 and S-2. In buildings with occupancies in Groups A, B, E, F-1, H, I-1, I-3, I-4, M, R-1, R-2, R-4, S-1 and S-2 *work areas* shall be provided with automatic sprinkler protection where all of the following conditions occur:

1. The *work area* is required to be provided with automatic sprinkler protection in accordance with the *Building Code of New York State* as applicable to new construction.
2. The building site has sufficient municipal water supply for design and installation of an automatic sprinkler system.

Exception: If the building site does not have sufficient municipal water supply for design of an automatic sprinkler system, *work areas* shall be protected by an automatic smoke detection system throughout all occupiable spaces other than sleeping units or individual dwelling units that activates the occupant notification system in accordance with Sections 907.4, 907.5 and 907.6 of the *Building Code of New York State*.

904.1.5 Group I-2. In Group I-2 occupancies, an automatic sprinkler system installed in accordance with Section 903.3.1.1 of the *Fire Code of New York State* shall be provided in the following:

1. In Group I-2, Condition 1, throughout the *work area*.
2. In Group I-2, Condition 2, throughout the *work area* where the *work area* is 50 percent or less of the smoke compartment.
3. In Group I-2, Condition 2, throughout the smoke compartment in which the work occurs where the *work area* exceeds 50 percent of the smoke compartment.

904.1.6 Windowless stories. Work located in a windowless story, as determined in accordance with the *Building Code of New York State*, shall be sprinklered where the *work area* is required to be sprinklered under the provisions of the *Building Code of New York State* for newly constructed buildings and the building site has a sufficient municipal water supply for the design and installation of an automatic sprinkler system.

904.1.7 Other required automatic sprinkler systems. In buildings and areas listed in Table 903.2.11.6 of the *Building Code of New York State*, *work areas* shall be provided with an automatic sprinkler system under the following conditions:

1. The *work area* is required to be provided with an automatic sprinkler system in accordance with the *Building Code of New York State* applicable to new construction.
2. The building site has sufficient municipal water supply for design and installation of an automatic sprinkler system.

904.1.8 Supervision and alarms. Where an automatic sprinkler system is required by Sections 904.1.1 through 904.1.7, such systems shall be provided with supervision and alarms in accordance with Section 903.4 of the *Building Code of New York State*.

904.2 Fire alarm and detection systems. Fire alarm and detection shall be provided in accordance with Section 907 of the *Building Code of New York State* as required for new construction.

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904.2.1 Manual fire alarm systems. Where required by the *Building Code of New York State*, a manual fire alarm system shall be provided throughout the *work area*. Alarm notification appliances shall be provided on such floors and shall be automatically activated as required by the *Building Code of New York State*.

Exceptions:

1. Alarm-initiating and notification appliances shall not be required to be installed in tenant spaces outside of the *work area*.
2. Visual alarm notification appliances are not required, except where an existing alarm system is upgraded or replaced or where a new fire alarm system is installed.

904.2.2 Automatic fire detection. Where required by the *Building Code of New York State* for new buildings, automatic fire detection systems shall be provided throughout the *work area*.

SECTION 905—MEANS OF EGRESS

905.1 General. The means of egress shall comply with the requirements of Section 804 except as specifically required in Sections 905.2 and 905.3.

905.2 Means-of-egress lighting. Means of egress from the highest *work area* floor to the floor of exit discharge shall be provided with artificial lighting within the exit enclosure in accordance with the requirements of the *Building Code of New York State*.

905.3 Exit signs. Means of egress from the highest *work area* floor to the floor of exit discharge shall be provided with exit signs in accordance with the requirements of the *Building Code of New York State*.

905.4 Two-way communications systems. In buildings with elevator service, a two-way communication system shall be provided where required by Section 1009.8 of the *Building Code of New York State*.

SECTION 906—STRUCTURAL

[BS] 906.1 General. Where buildings are undergoing Level 3 *alterations*, the provisions of this section shall apply.

[BS] 906.2 Existing structural elements resisting lateral loads. Where work involves a *substantial structural alteration,* the lateral load-resisting system of the altered building shall be shown to satisfy the requirements of Section 1609 of the *Building Code of New York State* and Section 304.3.2 of this code. Where the building is assigned to Seismic Design Category D or F, supports and attachments for nonstructural components required to serve any portion of the building with a use included in *Risk Category* IV shall comply with Section 1613 of the *Building Code of New York State* or shall comply with ASCE 41 using an objective of Position Retention nonstructural performance with the BSE-1E earthquake hazard level.

Exceptions:

1. Buildings of Group R occupancy with not more than five dwelling or sleeping units used solely for residential purposes that are altered based on the conventional light-frame construction methods of the *Building Code of New York State* or in compliance with the provisions of the *Residential Code of New York State*.
2. Where the intended alteration involves only the lowest story of a building, structural components of the lateral load resisting system above that story need not comply with this section.

[BS] 906.3 Seismic Design Category F. Where the building is assigned to Seismic Design Category F, the lateral force-resisting system of the altered building shall meet the requirements of Section 1609 of the *Building Code of New York State* and Section 304.3.2 of this code. Supports and attachments for nonstructural components serving any portion of the building with a use included in *Risk Category* IV shall comply with Section 1613 of the *Building Code of New York State* or shall comply with ASCE 41 using an objective of Position Retention nonstructural performance with the BSE-1E earthquake hazard level.

[BS] 906.4 Anchorage for concrete and masonry buildings. For any building assigned to Seismic Design Category D, E or F with a structural system that includes concrete or reinforced masonry walls with a flexible roof diaphragm, the *alteration* shall comply with Section 304.3.2 by evaluation of the existing condition or by installation of wall anchors at the roof line of all subject buildings and at the floor lines of unreinforced masonry.

[BS] 906.5 Anchorage for unreinforced masonry walls. For any building assigned to Seismic Design Category C, D, E or F with a structural system that includes unreinforced masonry bearing walls, the *alteration* shall comply with Section 304.3.2 by evaluation of the existing condition or by installation of wall anchors at the roof line.

[BS] 906.6 Bracing for unreinforced masonry parapets. Parapets constructed of unreinforced masonry in buildings assigned to Seismic Design Category C, D, E or F shall comply with Section 304.3.2 by evaluation of the existing condition or by installation of parapet bracing.

[BS] 906.7 Anchorage of unreinforced masonry partitions. Where the building is assigned to Seismic Design Category C, D, E or F, unreinforced masonry partitions and nonstructural walls within the *work area* and adjacent to egress paths from the *work area* shall have their existing conditions evaluated or shall be anchored, removed or altered to resist out-of-plane seismic forces to comply with Section 304.3.2.

SECTION 907—ENERGY CONSERVATION

907.1 Minimum requirements. Level 3 *alterations* to *existing buildings* or structures are permitted without requiring the entire building or structure to comply with the energy requirements of the *Energy Conservation Construction Code of New York State* or *Resi-*

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dential Code of New York State. The *alterations* shall conform to the energy requirements of the *Energy Conservation Construction Code of New York State* as it relates to new construction only.

SECTION 908—EMERGENCY RESPONDER COMMUNICATIONS ENHANCEMENT SYSTEM COVERAGE

908.1 Emergency responder communication enhancement system coverage. The *existing building* shall undergo an evaluation of the emergency responder communication signal strength and coverage area within the entire building in accordance with Sections 908.1.1 and 908.1.2.

Exception: Where it is determined by the fire *code official* that the emergency responder communication enhancement system (ERCES) is not needed.

908.1.1 Evaluation. The evaluation shall determine the current signal strength and coverage capabilities of the public safety communication systems utilized by the jurisdiction, measured at the exterior of the building.

908.1.2 Compliance. The evaluation report shall be submitted for approval by the fire code official and the frequency license holder. Where the coverage area, signal strength or DAQ does not comply with Section 510 of the *Fire Code of New York State*, the *existing building* shall be provided with ERCES coverage. The fire code official is authorized to establish the timeframe for such installation or modification.

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CHAPTER

10 CHANGE OF OCCUPANCY

User notes:

***About this chapter**:* *The purpose of this chapter is to provide regulations for the circumstances where an existing building is subject to a change of occupancy or a change of occupancy classification. A change of occupancy is not to be confused with a change of occupancy classification. The Building Code of New York State defines different occupancy classifications in Chapter 3 and special occupancy requirements in Chapter 4. Within specific occupancy classifications there can be many different types of actual activities that can take place. For instance, a Group A-3 occupancy classification deals with a wide variation of different types of activities, including bowling alleys and courtrooms, indoor tennis courts and dance halls. When a facility changes use from, for example, a bowling alley to a dance hall, the occupancy classification remains A-3, but the different uses could lead to drastically different code requirements. Therefore, this chapter deals with the special circumstances that are associated with a change in the use of a building within the same occupancy classification as well as a change of occupancy classification.*

SECTION 1001—GENERAL

1001.1 Scope. The provisions of this chapter shall apply where a *change of occupancy* occurs, as defined in Section 202.

1001.2 Certificate of occupancy. A *change of occupancy* or a *change of occupancy* within a space where there is a different fire protection system threshold requirement in Chapter 9 of the current *Building Code of New York State* than exists in the current building or space shall not be made to any structure without the approval of the *code official*. A certificate of occupancy shall be issued where it has been determined that the requirements for the *change of occupancy* have been met.

1001.2.1 Change of use. Any work undertaken in connection with a change in use shall conform to the applicable requirements for the work as classified in Chapter 6 and to the requirements of Sections 1002 through 1010.

Exception: As modified in Section 1204 for *historic buildings*.

1001.2.2 Change of occupancy classification. Where a building undergoes a change of occupancy classification, the provisions of Sections 1002 through 1011 shall apply.

1001.2.2.1 Partial change of occupancy. Where a portion of an *existing building* undergoes a change of occupancy classification, Section 1011 shall apply.

1001.3 Certificate of occupancy required. A certificate of occupancy shall be issued where a *change of occupancy* occurs that results in a different occupancy classification as determined by the *Building Code of New York State*.

SECTION 1002—SPECIAL USE AND OCCUPANCY

1002.1 Compliance with the building code. Where an *existing building* or part of an *existing building* undergoes a *change of occupancy* to one of the special use or occupancy categories as described in Chapter 4 in the *Building Code of New York State*, the building shall comply with all of the requirements of Chapter 4 of the *Building Code of New York State* applicable to the special use or occupancy.

1002.2 Incidental uses. Where a portion of a building undergoes a *change of occupancy* to one of the incidental uses listed in Table 509.1 of the *Building Code of New York State*, the incidental use shall comply with Section 509 of the *Building Code of New York State* applicable to the incidental use.

1002.3 Change of occupancy in health care. Where a *change of occupancy* occurs to a Group I-2 or I-1 *facility*, the *work area* with the *change of occupancy* shall comply with the *Building Code of New York State*.

Exceptions:

1. A *change in use* or occupancy in the following cases shall not be required to meet the *Building Code of New York State*:
   - 1.1. Group I-2, Condition 2 to Group I-2, Condition 1.
   - 1.2. Group I-2 to ambulatory health care.
   - 1.3. Group I-2 to Group I-1.
   - 1.4. Group I-1, Condition 2 to Group I-1, Condition 1.
2. In a Group I-1 occupancy, where a *change of use* is not in conjunction with a Level 3 *alteration*, a smoke barrier in accordance with Section 420.6 of the *Building Code of New York State* is not required to be added.

1002.4 Storage. In Group I-2 occupancies, equipped throughout with an automatic sprinkler in accordance with Section 903.3.1.1 of the *Building Code of New York State*, where a room 250 square feet (23.2 m^2) or less undergoes a change in occupancy to a storage room, the room shall be separated from the remainder of the building by construction capable of resisting the passage of smoke in accordance with Section 509.4.2 of the *Building Code of New York State*.

SECTION 1003—BUILDING ELEMENTS AND MATERIALS

1003.1 General. Building elements and materials in portions of buildings undergoing a change of occupancy classification shall comply with Section 1011.

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SECTION 1004—FIRE PROTECTION

1004.1 General. Fire protection requirements in Section 1011 shall apply where either of the following occur:

1. A building or portion thereof undergoes a *change of occupancy*.
2. A building or portion thereof undergoes a *change of occupancy* and there is a different fire protection system threshold requirement in Chapter 9 of the current *Building Code of New York State* than exists in the current building or portion thereof.

SECTION 1005—MEANS OF EGRESS

1005.1 General. Means of egress in portions of buildings undergoing a change of occupancy classification shall comply with Section 1011.

SECTION 1006—STRUCTURAL

[BS] 1006.1 Live loads. Structural elements carrying tributary live loads from an area with a *change of occupancy* shall satisfy the requirements of Section 1607 of the *Building Code of New York State*. Design live loads for areas of new occupancy shall be based on Section 1607 of the *Building Code of New York State*. Design live loads for other areas shall be permitted to use previously *approved* design live loads.

Exception: Structural elements whose demand-capacity ratio considering the *change of occupancy* is not more than 5 percent greater than the demand-capacity ratio based on previously *approved* live loads.

[BS] 1006.2 Snow and wind loads. Where a *change of occupancy* results in a structure being assigned to a higher *risk category*, the structure shall satisfy the requirements of Sections 1608 and 1609 of the *Building Code of New York State* for the new *risk category*.

Exception: Where the area of the new occupancy is less than 10 percent of the building area. The cumulative effect of occupancy changes over time shall be considered.

[BS] 1006.3 Seismic loads. Where a *change of occupancy* results in a building being assigned to a higher *risk category*, or where the change is from a Group S or Group U occupancy to any occupancy other than Group S or Group U, the lateral force-resisting system of the building shall comply with Section 304.3.1 for the new *risk category*. Where a *change of occupancy* results in a building being assigned to *Risk Category* IV and Seismic Design Category D or F, nonstructural components serving any portion of the building changed to *Risk Category* IV shall comply with the requirements of Section 1613 of the *Building Code of New York State* or shall comply with ASCE 41 using an objective of operational nonstructural performance with the BSE-1N earthquake hazard level.

Exceptions:

1. Where a *change of use* results in a building being reclassified from *Risk Category* I or II to *Risk Category* III and the seismic coefficient, S_{DS}, is less than 0.33, compliance with this section is not required.
2. Where the area of the new occupancy is less than 10 percent of the building area, the occupancy is not changing from a Group S or Group U occupancy, and the new occupancy is not assigned to *Risk Category* IV, compliance with this section is not required. The cumulative effect of occupancy changes over time shall be considered.
3. Unreinforced masonry bearing wall buildings assigned to *Risk Category* III and to Seismic Design Category A or B shall be permitted to use Appendix Chapter A1 of this code.
4. Where the change is from a Group S or Group U occupancy and there is no change of *risk category*, compliance with Section 304.3.2 shall be permitted.

[BS] 1006.4 Access to Risk Category IV. Any structure that provides operational access to an adjacent structure assigned to *Risk Category* IV as the result of a change of occupancy shall itself comply with Sections 1608 and 1609 of the *Building Code of New York State* and Section 304.3.1 of this code. Where operational access to *Risk Category* IV is less than 10 feet (3048 mm) from either an interior lot line or from another structure, access protection from potential falling debris shall be provided.

SECTION 1007—ELECTRICAL

1007.1 Special occupancies. Where the occupancy of an *existing building* or part of an *existing building* is changed to one of the following special occupancies as described in NFPA 70, the electrical wiring and equipment of the building or portion thereof that contains the proposed occupancy shall comply with the applicable requirements of NFPA 70. Health care *facilities*, including Group I-2, ambulatory health care *facilities* and outpatient clinics, shall also comply with the applicable requirements of NFPA 99:

1. Hazardous locations.
2. Commercial garages, repair and storage.
3. Aircraft hangars.
4. Gasoline dispensing and service stations.
5. Bulk storage plants.
6. Spray application, dipping and coating processes.
7. Health care *facilities*, including Group I-2, ambulatory health care *facilities* and outpatient clinics.
8. Places of assembly.
9. Theaters, audience areas of motion picture and television studios, and similar locations.

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10. Motion picture and television studios and similar locations.
11. Motion picture projectors.
12. Agricultural buildings.

1007.2 Unsafe conditions. Where the occupancy of an *existing building* or part of an *existing building* is changed, all *unsafe* conditions shall be corrected without requiring that all parts of the electrical system comply with NFPA 70.

1007.3 Service upgrade. Where the occupancy of an *existing building* or part of an *existing building* is changed, electrical service shall be upgraded to meet the requirements of NFPA 70 for the new occupancy.

1007.4 Number of electrical outlets. Where the occupancy of an *existing building* or part of an *existing building* is changed, the number of electrical outlets shall comply with NFPA 70 for the new occupancy.

SECTION 1008—MECHANICAL

1008.1 Mechanical requirements. Where the occupancy of an *existing building* or part of an *existing building* is changed such that the new occupancy is subject to different kitchen exhaust requirements or to increased mechanical ventilation requirements in accordance with the *Mechanical Code of New York State*, the new occupancy shall comply with the respective *Mechanical Code of New York State* provisions.

SECTION 1009—PLUMBING

1009.1 Increased demand. Where the occupancy of an *existing building* or part of an *existing building* is changed such that the new occupancy is subject to increased or different plumbing fixture requirements or to increased water supply requirements in accordance with the *Plumbing Code of New York State*, the new occupancy shall comply with the intent of the respective *Plumbing Code of New York State* provisions.

Exception: Only where the occupant load of the story is increased by more than 20 percent, plumbing fixtures for the story shall be provided in quantities specified in the *Plumbing Code of New York State* based on the increased occupant load.

1009.2 Food-handling occupancies. If the new occupancy is a food-handling establishment, all existing sanitary waste lines above the food or drink preparation or storage areas shall be panned or otherwise protected to prevent leaking pipes or condensation on pipes from contaminating food or drink. New drainage lines shall not be installed above such areas and shall be protected in accordance with the *Plumbing Code of New York State*.

1009.3 Interceptor required. If the new occupancy will produce grease or oil-laden wastes, interceptors shall be provided as required in the *Plumbing Code of New York State*.

1009.4 Chemical wastes. If the new occupancy will produce chemical wastes, the following shall apply:

1. If the existing piping is not compatible with the chemical waste, the waste shall be neutralized prior to entering the drainage system or the piping shall be changed to a compatible material.
2. Chemical waste shall not discharge to a public sewer system without the approval of the sewage authority.

1009.5 Group I-2. If the occupancy group is changed to Group I-2, the plumbing system and medical gas system shall comply with the applicable requirements of the *Plumbing Code of New York State*.

SECTION 1010—OTHER REQUIREMENTS

1010.1 Light and ventilation. Light and ventilation shall comply with the requirements of the *Building Code of New York State* for the new occupancy.

[NY] 1010.2 Fire apparatus access. Where a *change of occupancy* classification is made to a higher-hazard category (lower number) as shown in Table 1011.6, fire apparatus access roads shall be provided and maintained in accordance with the requirements of the *Fire Code of New York State* for the new occupancy.

SECTION 1011—CHANGE OF OCCUPANCY CLASSIFICATION

1011.1 General. The provisions of this section shall apply to buildings or portions thereof undergoing a change of occupancy classification. This includes a change of occupancy classification within a group as well as a change of occupancy classification from one group to a different group. The provisions of this section shall also apply where there is a *change of occupancy* within a building or portion thereof and there is a different fire protection system threshold requirement in Chapter 9 of the current *Building Code of New York State* than exists in the current building or space. Such buildings shall also comply with Sections 1002 through 1010 of this code.

1011.2 Fire protection systems. Fire protection systems shall be provided in accordance with Sections 1011.2.1 and 1011.2.2.

1011.2.1 Automatic sprinkler system. The installation of an automatic sprinkler system shall be required where there is a *change of occupancy* classification and Chapter 9 of the current *Building Code of New York State* requires an automatic sprinkler system based on the new occupancy or where there is a change of occupancy within the space where there is a different fire protection system threshold requirement in Chapter 9 of the current *Building Code of New York State* than exists in the current building or space. The installation of the automatic sprinkler system shall be required within the area of the *change of occupancy* and areas of the building not separated horizontally and vertically from the change of occupancy by a nonrated permanent partition and horizontal assemblies, fire partition, smoke partition, smoke barrier, fire barrier or fire wall.

Exceptions:

1. An automatic sprinkler system shall not be required in a one- or two-family dwelling constructed in accordance with the *Residential Code of New York State*.
2. Automatic sprinkler system shall not be required in a townhouse constructed in accordance with the *Residential Code of New York State*.
3. The townhouse shall be separated from adjoining units in accordance with Section R302.2 of the *Residential Code of New York State*.

1011.2.1.1 Nonrequired automatic sprinkler systems. The *code official* is authorized to permit the removal of an existing automatic sprinkler system where all of the following conditions exist:

1. The system is not required for new construction.
2. Portions of the system that are exposed to the public are removed.
3. The system was not installed as part of any special construction features, including fire-resistance-rated assemblies and smoke-resistive assemblies, conditions of occupancy, means of egress conditions, fire code deficiencies, *approved* modifications or *approved* alternative materials, design and methods of construction, and equipment applying to the building.

1011.2.1.1.1 Approval. Plans, investigation and evaluation reports, and other data shall be submitted documenting compliance with Section 1011.2.1.1 for review and approval in support of a determination authorizing the removal of the automatic sprinkler system by the *code official*.

1011.2.2 Fire alarm and detection system. Where a change in occupancy classification occurs or where there is a *change of occupancy* within a space where there is a different fire protection system threshold requirement in Chapter 9 of the current *Building Code of New York State* than exists in the current building or space that requires a fire alarm and detection system to be provided based on the new occupancy in accordance with Chapter 9 of the *Building Code of New York State*, such system shall be provided throughout the area where the *change of occupancy* occurs. Existing alarm notification appliances shall be automatically activated throughout the building. Where the building is not equipped with a fire alarm system, alarm notification appliances shall be provided throughout the area where the *change of occupancy* occurs in accordance with Section 907 of the *Building Code of New York State* as required for new construction.

1011.3 Interior finish. In areas of the building undergoing the change of occupancy classification, the interior finish of walls and ceilings shall comply with the requirements of the *Building Code of New York State* for the new occupancy classification.

[NY] 1011.4 Reserved.

1011.5 Means of egress, general. Hazard categories in regard to life safety and means of egress shall be in accordance with Table 1011.5.

TABLE 1011.5—MEANS OF EGRESS HAZARD CATEGORIES

RELATIVE HAZARD	OCCUPANCY CLASSIFICATIONS
1 (Highest Hazard)	H
2	I-2; I-3; I-4
3	A; E; I-1; M; R-1; R-2; R-4, Condition 2
4	B; F-1; R-3; R-4, Condition 1; S-1
5 (Lowest Hazard)	F-2; S-2; U

1011.5.1 Means of egress for change to a higher-hazard category. Where a change of occupancy classification is made to a higher-hazard category (lower number) as shown in Table 1011.5, the means of egress shall comply with the requirements of Chapter 10 of the *Building Code of New York State*.

Exceptions:

1. Stairways shall be enclosed in compliance with the applicable provisions of Section 903.1.
2. Existing stairways including handrails and guards complying with the requirements of Chapter 9 shall be permitted for continued use subject to approval of the *code official*.
3. Any stairway replacing an existing stairway within a space where the pitch or slope cannot be reduced because of existing construction shall not be required to comply with the maximum riser height and minimum tread depth requirements.
4. Existing corridor walls constructed on both sides of wood lath and plaster in good condition or $^1/_2$-inch-thick (12.7 mm) gypsum wallboard shall be permitted. Such walls shall either terminate at the underside of a ceiling of equivalent construction or extend to the underside of the floor or roof next above.
5. Existing corridor doorways, transoms and other corridor openings shall comply with the requirements in Sections 804.7.1, 804.7.2 and 804.7.3.
6. Existing dead-end corridors shall comply with the requirements in Section 804.8.

7. An operable window complying with Section 1011.5.6 shall be accepted as an *emergency escape and rescue opening*.
8. In Group I-1 and I-2 facilities, required guards enclosing the *occupiable roof* areas shall be permitted to be greater than 48 inches (1219 mm) above the surface of the *occupiable roof* where the occupants, because of clinical needs, require restraint or containment as part of a function of a psychiatric or cognitive treatment area.

1011.5.2 Means of egress for change of use to an equal or lower-hazard category. Where a change of occupancy classification is made to an equal or lesser-hazard category (higher number) as shown in Table 1011.5, existing elements of the means of egress shall comply with the requirements of Section 905 for the new occupancy classification. Newly constructed or configured means of egress shall comply with the requirements of Chapter 10 of the *Building Code of New York State*.

Exceptions:

1. Any stairway replacing an existing stairway within a space where the pitch or slope cannot be reduced because of existing construction shall not be required to comply with the maximum riser height and minimum tread depth requirements.
2. In Group I-1 and I-2 facilities, required guards enclosing the *occupiable roof* areas shall be permitted to be greater than 48 inches (1219 mm) above the surface of the *occupiable roof* where the occupants, because of clinical needs, require restraint or containment as part of a function of a psychiatric or cognitive treatment area.

1011.5.3 Egress capacity. Egress capacity shall meet or exceed the occupant load as specified in the *Building Code of New York State* for the new occupancy.

1011.5.4 Handrails. Existing stairways shall comply with the handrail requirements of Section 804.13 in the area of the change of occupancy classification.

1011.5.5 Guards. Existing guards shall comply with the requirements in Section 804.12 in the area of the change of occupancy classification.

1011.5.6 Existing emergency escape and rescue openings. Where a *change of occupancy* would require an *emergency escape and rescue opening* in accordance with Section 1031 of the *Building Code of New York State*, operable windows serving as the *emergency escape and rescue opening* shall comply with the following:

1. An existing operable window shall provide a minimum net clear opening of 4 square feet (0.38 m^2) with a minimum net clear opening height of 22 inches (559 mm) and a minimum net clear opening width of 20 inches (508 mm).
2. A replacement window where such window complies with both of the following:
   2.1. The replacement window meets the size requirements in Item 1.
   2.2. The replacement window is the manufacturer's largest standard size window that will fit within the existing frame or existing rough opening. The replacement window shall be permitted to be of the same operating style as the existing window or a style that provides for an equal or greater window opening area than the existing window.

1011.6 Heights and areas. Hazard categories in regard to height and area shall be in accordance with Table 1011.6.

TABLE 1011.6—HEIGHTS AND AREAS HAZARD CATEGORIES

RELATIVE HAZARD	OCCUPANCY CLASSIFICATIONS
1 (Highest Hazard)	H
2	A-1; A-2; A-3; A-4; I; R-1; R-2; R-4, Condition 2
3	E; F-1; S-1; M
4 (Lowest Hazard)	B; F-2; S-2; A-5; R-3; R-4, Condition 1; U

1011.6.1 Height and area for change to a higher-hazard category. Where a change of occupancy classification is made to a higher-hazard category as shown in Table 1011.6, heights and areas of buildings and structures shall comply with the requirements of Chapter 5 of the *Building Code of New York State* for the new occupancy classification.

Exceptions:

1. For high-rise buildings constructed in compliance with a previously issued permit, the type of construction reduction specified in Section 403.2.1 of the *Building Code of New York State* is permitted. This shall include the reduction for columns. The high-rise building is required to be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 of the *Building Code of New York State*.
2. Buildings that were constructed in compliance with a previously issued permit that have floor assemblies with a 1-$^1/_2$-hour fire resistance rating shall not be required to comply with Chapter 5 of the *Building Code of New York State* where all of the following apply:
   2.1. Chapter 5 of the *Building Code of New York State* requires Type IB construction.
   2.2. The building does not include Group H occupancies.
   2.3. The building is protected throughout with an automatic sprinkler system in accordance Section 903.3.1.1 of the *Building Code of New York State.*

1011.6.1.1 Fire wall alternative. In other than Groups H, F-1 and S-1, fire barriers and horizontal assemblies constructed in accordance with Sections 707 and 711, respectively, of the *Building Code of New York State* shall be permitted to be used in lieu of fire walls to subdivide the building into separate buildings for the purpose of complying with the area limitations required for the new occupancy where all of the following conditions are met:

1. The buildings are protected throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 of the *Fire Code of New York State*.
2. The maximum allowable area between fire barriers, horizontal assemblies or any combination thereof shall not exceed the maximum allowable area determined in accordance with Chapter 5 of the *Building Code of New York State* without an increase allowed for an automatic sprinkler system in accordance with Section 506 of the *Building Code of New York State*.
3. The fire-resistance rating of the fire barriers and horizontal assemblies shall be not less than that specified for fire walls in Table 706.4 of the *Building Code of New York State*.

Exception: Where horizontal assemblies are used to limit the maximum allowable area, the required fire-resistance rating of the horizontal assemblies shall be permitted to be reduced by 1 hour provided that the height and number of stories increases allowed for an automatic sprinkler system by Section 504 of the *Building Code of New York State* are not used for the buildings.

1011.6.2 Height and area for change to an equal or lesser-hazard category. Where a change of occupancy classification is made to an equal or lesser-hazard category as shown in Table 1011.6, the height and area of the *existing building*shall be deemed acceptable.

1011.6.3 Fire barriers. Where a *change of occupancy* classification is made to a higher-hazard category as shown in Table 1011.6, fire barriers in separated mixed use buildings shall comply with the fire-resistance requirements of the *Building Code of New York State*.

Exception: Where the fire barriers are required to have a 1-hour fire-resistance rating, existing wood lath and plaster in good condition or existing $^{1}/_{2}$-inch-thick (12.7 mm) gypsum wallboard shall be permitted.

1011.7 Exterior wall fire-resistance ratings. Hazard categories in regard to fire-resistance ratings of exterior walls shall be in accordance with Table 1011.7.

TABLE 1011.7—EXPOSURE OF EXTERIOR WALLS HAZARD CATEGORIES

RELATIVE HAZARD	OCCUPANCY CLASSIFICATION
1 (Highest Hazard)	H
2	F-1; M; S-1
3	A; B; E; I; R
4 (Lowest Hazard)	F-2; S-2; U

1011.7.1 Exterior wall rating for change of occupancy classification to a higher-hazard category. Where a change of occupancy classification is made to a higher hazard category as shown in Table 1011.7, exterior walls shall have fire-resistance, exterior opening areas and opening protectives as required by the *Building Code of New York State*.

Exception: A 2-hour fire-resistance rating shall be allowed where the building does not exceed three stories in height and is classified as one of the following groups: A-2 and A-3 with an occupant load of less than 300, B, F, M or S.

1011.7.2 Exterior wall rating for change of occupancy classification to an equal or lesser-hazard category. Where a change of occupancy classification is made to an equal or lesser-hazard category as shown in Table 1011.7, existing exterior walls, including openings, shall be accepted.

1011.7.3 Opening protectives. Openings in exterior walls shall be protected as required by the *Building Code of New York State*. Where openings in the exterior walls are required to be protected because of their distance from the lot line, the sum of the area of such openings shall not exceed 50 percent of the total area of the wall in each story.

Exceptions:

1. Where the *Building Code of New York State* permits openings in excess of 50 percent.
2. Protected openings shall not be required in buildings of Group R occupancy that do not exceed three stories in height and that are located not less than 3 feet (914 mm) from the lot line.
3. Exterior opening protectives are not required where an automatic sprinkler system has been installed throughout.
4. Exterior opening protectives are not required where the *change of occupancy* group is to an equal or lower hazard classification in accordance with Table 1011.7.

1011.8 Enclosure of vertical shafts. Enclosure of vertical shafts shall be in accordance with Sections 1011.8.1 through 1011.8.4.

1011.8.1 Minimum requirements. Vertical shafts shall be designed to meet the *Building Code of New York State* requirements for atriums or the requirements of this section.

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1011.8.2 Stairways. Where a change of occupancy classification is made to a higher-hazard category as shown in Table 1011.5, interior stairways shall be enclosed as required by the *Building Code of New York State*.

Exceptions:

1. In other than Group I occupancies, an enclosure shall not be required for openings serving only one adjacent floor and that are not connected with corridors or stairways serving other floors.
2. Unenclosed existing stairways need not be enclosed in a continuous vertical shaft if each story is separated from other stories by 1-hour fire-resistance-rated construction or *approved* wired glass set in steel frames and all exit corridors are sprinklered in accordance with the *Building Code of New York State*. The openings between the corridor and the tenant space shall have not fewer than one sprinkler above the openings on the tenant side.
3. Existing penetrations of stairway enclosures shall be accepted if they are protected in accordance with the *Building Code of New York State*.

1011.8.3 Other vertical shafts. Interior vertical shafts other than stairways, including but not limited to elevator hoistways and service and utility shafts, shall be enclosed as required by the *Building Code of New York State* where there is a *change of use* to a higher-hazard category as specified in Table 1011.5.

Exceptions:

1. Existing 1-hour interior shaft enclosures shall be accepted where a higher rating is required.
2. Vertical openings, other than stairways, in buildings of other than Group I occupancy and connecting less than six stories shall not be required to be enclosed if the entire building is provided with an *approved* automatic sprinkler system.

1011.8.4 Openings. Openings into existing vertical shaft enclosures shall be protected by fire assemblies having a fire protection rating of not less than 1 hour and shall be maintained self-closing or shall be automatic-closing by actuation of a smoke detector. Other openings shall be fire protected in an *approved* manner. Existing fusible link-type automatic door-closing devices shall be permitted in all shafts except stairways if the fusible link rating does not exceed 135°F (57°C).

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CHAPTER

11 ADDITIONS

User notes:

About this chapter: *Chapter 11 provides the requirements for additions, which correlate to the code requirements for new construction. There are, however, some exceptions that are specifically stated within this chapter. An "Addition" is defined in Chapter 2 as "an extension or increase in the floor area, number of stories or height of a building or structure." Chapter 11 contains the minimum requirements for an addition that is not separated from the existing building by a fire wall.*

SECTION 1101—GENERAL

1101.1 Scope. An *addition* to a building or structure shall comply with the *Uniform Code* as adopted for new construction without requiring the *existing building* or structure to comply with any requirements of those codes or of these provisions, except as required by this chapter. Where an *addition* impacts the *existing building* or structure, that portion shall comply with this code.

1101.2 Creation or extension of nonconformity. An *addition* shall not create or extend any nonconformity in the *existing building* to which the *addition* is being made with regard to accessibility, structural strength, supports and attachments for nonstructural components, fire safety, means of egress or the capacity of mechanical, plumbing or electrical systems.

Exception: Nonconforming supports and attachments for nonstructural components that serve the *addition* from within the existing building need not be altered to comply with *Building Code of New York State* Section 1613 unless the components are part of the *addition*'s life safety system or are required to serve an *addition* assigned to *Risk Category* IV.

[BS] 1101.3 Risk category assignment. Where the *addition* and the *existing building* have different occupancies, the *risk category* of each existing and added occupancy shall be determined in accordance with Section 1604.5.1 of the *Building Code of New York State*. Where application of that section results in a higher *risk category* for the *existing building* compared with the *risk category* for the *existing building* before the *addition*, such a change shall be considered a *change of occupancy* and shall comply with Chapter 10 of this code. Where application of that section results in a higher *risk category* for the *addition* compared with the *risk category* for the *addition* by itself, the *addition* and any systems in the *existing building* required to serve the *addition* shall comply with the requirements of the *Building Code of New York State* for new construction for the higher *risk category*.

1101.4 Other work. Any *repair* or *alteration* work within an *existing building* to which an *addition* is being made shall comply with the applicable requirements for the work as classified in Chapter 6.

1101.5 Smoke barriers in Group I-1, Condition 2. Where an *addition* to an existing Group I-1, Condition 2 building adds sleeping areas that result in more than 50 care recipients on a story, smoke barriers shall be provided to subdivide such story into not fewer than two smoke compartments in accordance with Section 420.6 of the *Building Code of New York State*.

Exception: Where the *existing building* is divided into smoke compartments and the *addition* does not result in any individual smoke compartment exceeding the size and travel distance requirements in Section 420.6 of the *Building Code of New York State*, additional smoke barriers are not required.

[NY] 1101.6 Reserved.

1101.7 Occupiable roofs. Where a new *occupiable roof* is added to a building or structure, the *occupiable roof* shall comply with the provisions of the *Building Code of New York State*.

SECTION 1102—HEIGHTS AND AREAS

1102.1 Height limitations. An *addition* shall not increase the height of an *existing building* beyond that permitted under the applicable provisions of Chapter 5 of the *Building Code of New York State* for new buildings.

1102.2 Area limitations. An *addition* shall not increase the area of an *existing building* beyond that permitted under the applicable provisions of Chapter 5 of the *Building Code of New York State* for new buildings unless fire separation as required by the *Building Code of New York State* is provided.

Exception: In-filling of floor openings and nonoccupiable appendages such as elevator and exit stairway shafts shall be permitted beyond that permitted by the *Building Code of New York State*.

1102.3 Fire protection systems. Existing fire areas increased by the *addition* shall comply with Chapter 9 of the *Building Code of New York State*.

Exception: Nonoccupiable appendages, such as elevator and exit stairway shafts, shall be permitted beyond that permitted by the *Building Code of New York State*.

SECTION 1103—STRUCTURAL

[BS] 1103.1 Additional gravity loads. Any existing gravity load-carrying structural element for which an *addition* and its related *alterations* cause an increase in design dead, live or snow load, including snow drift effects, of more than 5 percent shall be replaced or altered as needed to carry the gravity loads required by the *Building Code of New York State* for new structures. Any existing gravity load-carrying structural element whose gravity load-carrying capacity is decreased as part of the *addition* and its related *alterations*

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shall be considered to be an altered element subject to the requirements of Section 805.2. Any existing element that will form part of the lateral load path for any part of the *addition* shall be considered to be an existing lateral load-carrying structural element subject to the requirements of Section 1103.2.

Exception: Buildings of Group R occupancy with not more than five dwelling units or sleeping units used solely for residential purposes where the *existing building* and the *addition* together comply with the conventional light-frame construction methods of the *Building Code of New York State* or the provisions of the *Residential Code of New York State*.

[BS] 1103.2 Lateral force-resisting system. Where the *addition* is structurally independent of the *existing structure*, existing lateral load-carrying structural elements shall be permitted to remain unaltered. Where the *addition* is not structurally independent of the *existing structure*, the lateral force-resisting system of the *existing structure* and its *addition* acting together as a single structure shall comply with Section 1609 of the *Building Code of New York State* and Section 304.3.1 of this code.

Exceptions:

1. Buildings of Group R occupancy with not more than five dwelling or sleeping units used solely for residential purposes where the *existing building* and the *addition* comply with the conventional light-frame construction methods of the *Building Code of New York State* or the provisions of the *Residential Code of New York State*.
2. Any existing lateral load-carrying structural element whose demand-capacity ratio with the *addition* considered is not more than 10 percent greater than its demand-capacity ratio with the *addition* ignored shall be permitted to remain unaltered. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces in accordance with Section 1609 of the *Building Code of New York State* and Section 304.3.1 of this code*. For purposes of this exception, comparisons of demand-capacity ratios and calculation of design lateral loads, forces and capacities shall account for the cumulative effects of additions and alterations since original construction.*

When calculating demand-capacity ratios for wind, the date of original construction shall be permitted to be taken as the date of completion of a prior *addition*, alteration or *repair* in compliance with Section 1609 of the *Building Code of New York State* or the code wind forces in effect at the time. When calculating demand-capacity ratios for earthquake, the date of original construction shall be permitted to be taken as the date of completion of a prior *addition*, *alteration* or *repair* in compliance with Section 304.3.1 or the full seismic forces in effect at the time.

[BS] 1103.3 Flood hazard areas. *Additions* and *foundations* in *flood hazard areas* shall comply with the following requirements:

1. For horizontal *additions* that are structurally interconnected to the *existing building*:
   - 1.1. If the *addition* and all other proposed work, when combined, constitute *substantial improvement*, the *existing building* and the *addition* shall comply with Section 1612 of the *Building Code of New York State*, or Section R306 of the *Residential Code of New York State*, as applicable.
   - 1.2. If the *addition* constitutes *substantial improvement*, the *existing building* and the *addition* shall comply with Section 1612 of the *Building Code of New York State*, or Section R306 of the *Residential Code of New York State*, as applicable.
   - 1.3. If the *addition* does not constitute *substantial improvement*, the *addition* is not required to comply with the flood design requirements for new construction, provided that both of the following apply:
     - 1.3.1. The *addition* shall not create or extend any nonconformity of the *existing building* with the flood-resistant construction requirements.
     - 1.3.2. The *lowest floor* of the *addition* shall be at or above the lower of the *lowest floor* of the *existing building* or the *lowest floor* elevation required in Section 1612 of the *Building Code of New York State*, or Section R306 of the *Residential Code of New York State*, as applicable.
2. For horizontal *additions* that are not structurally interconnected to the *existing building*:
   - 2.1. The *addition* shall comply with Section 1612 of the *Building Code of New York State*, or Section R306 of the *Residential Code of New York State*, as applicable.
   - 2.2. If the *addition* and all other proposed work, when combined, constitute *substantial improvement*, the *existing building* and the *addition* shall comply with Section 1612 of the *Building Code of New York State*, or Section R306 of the *Residential Code of New York State*, as applicable.
3. For vertical *additions* and all other proposed work that, when combined, constitute *substantial improvement*, the *existing building* shall comply with Section 1612 of the *Building Code of New York State*, or Section R306 of the *Residential Code of New York State*, as applicable.
4. For a new foundation, replacement foundation or a foundation raised or extended upward, the foundation shall comply with Section 1612 of the *Building Code of New York State,* or Section R306 of the *Residential Code of New York State*, as applicable.

SECTION 1104—ENERGY CONSERVATION

1104.1 Minimum requirements. *Additions* to *existing buildings* shall conform to the energy requirements of the *Energy Conservation Construction Code of New York State* as it relates to new construction.

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CHAPTER

12 HISTORIC BUILDINGS

User notes:

***About this chapter**:* *Chapter 12 provides some exceptions from code requirements when the building in question has historic value. The most important criterion for application of this chapter is that the building must be essentially accredited as being of historic significance by a state or local authority after careful review of the historical value of the building. Most, if not all, states have such authorities, as do many local jurisdictions. The agencies with such authority can be located at the state or local government level or through the local chapter of the American Institute of Architects (AIA). Other considerations include the structural condition of the building (i.e., is the building structurally sound), its proposed use, its impact on life safety and how the intent of the code, if not the letter, will be achieved.*

SECTION 1201—GENERAL

1201.1 Scope. This chapter is intended to provide means for the preservation of *historic buildings. Historic buildings* shall comply with the provisions of this chapter relating to their *repair*, *alteration*, relocation and *change of occupancy*.

[BS] 1201.2 Report. A *historic building* undergoing *alteration* or *change of occupancy* shall be investigated and evaluated, and a written report shall be prepared and filed with the *code official* by a *registered design professional* where required by the *code official*. The report shall identify all *unsafe* conditions as defined in Section 115. For buildings assigned to Seismic Design Category D, E or F, a description of the vertical and horizontal elements of the lateral force-resisting system and strengths or weaknesses therein shall be included. Additionally, the report shall describe the components of the building that provide a level of safety substantially below that required of existing nonhistoric buildings.

Exception: An investigation, evaluation and report shall not be required where the *alteration* is scoped by Section 602 as a Level 1 *alteration* and does not make the building or structure less compliant with the provisions of the *Building Code of New York State*.

1201.3 Special occupancy exceptions—museums. Where a building in Group R-3 is used for Group A, B or M purposes such as museum tours, exhibits and other public assembly activities, or for museums less than 3,000 square feet (279 m^2) per floor and a maximum of three stories, the occupancy shall be classified as Group B where life safety conditions are *approved* by the *code official* in accordance with Section 1201.2. Adequate means of egress in such buildings, including, but not limited to, a means of maintaining doors in an unlocked position to permit egress, a limit on building occupancy to an occupant load permitted by the means of egress capacity, a limit on occupancy of certain areas or floors, or supervision by a person knowledgeable in the emergency exiting procedures, shall be provided.

[NY] 1201.4 Flood hazard areas. In *flood hazard areas*, if all proposed work, including *repairs*, work required because of a *change of occupancy*, and *alterations*, constitutes *substantial improvement*, then the *existing building* shall comply with Section 1612 of the *Building Code of New York State*, or Section R306 of the *Residential Code of New York State*, as applicable.

Exception: If a *historic building* will continue to be a *historic building* after the proposed work is completed, then the proposed work is not considered a *substantial improvement*. For the purposes of this exception, a *historic building* is any of the following:

1. Listed, or certified as eligible for listing, in the National Register of Historic Places or in the New York State Register of Historic Places.
2. Designated as historic under an applicable state or local law.
3. Certified as a contributing resource within a National Register-listed, State Register-listed, or locally designated historic district.

1201.5 Unsafe conditions. Conditions determined by the *code official* to be *unsafe* shall be remedied. Work shall not be required beyond what is required to remedy the *unsafe* conditions.

SECTION 1202—REPAIRS

1202.1 General. Repairs to any portion of a *historic building* or structure shall be permitted with original or like materials and original methods of construction, subject to the provisions of this chapter. Hazardous materials, such as asbestos and lead-based paint, shall not be used where the code for new construction would not permit their use in buildings of similar occupancy, purpose and location.

1202.2 Replacement. Replacement of existing or missing features using original materials shall be permitted. Partial replacement for *repairs* that match the original in configuration, height and size shall be permitted.

Replacement glazing in hazardous locations shall comply with the safety glazing requirements of Chapter 24 of the *Building Code of New York State*.

Exception: Glass block walls, louvered windows and jalousies repaired with like materials.

SECTION 1203—FIRE SAFETY

1203.1 Scope. *Historic buildings* undergoing *alterations*, *changes of occupancy* or that are moved shall comply with Section 1203.

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1203.2 General. Every *historic building* that does not conform to the construction requirements specified in this code for the occupancy or use and that constitutes a distinct fire hazard as defined herein shall be provided with an *approved* automatic sprinkler system as determined appropriate by the *code official*. However, an automatic sprinkler system shall not be used to substitute for, or act as an alternative to, the required number of exits from any *facility*.

1203.3 Means of egress. Where, in the opinion of the *code official*, there is sufficient width and height for a person to pass through the opening or traverse the means of egress, existing door openings and corridor and stairway widths are not required to meet the widths required by the *Building Code of New York State* or this code. Where *approved* by the *code official*, the front or main exit doors need not swing in the direction of the path of exit travel, provided that other *approved* means of egress having sufficient capacity to serve the total occupant load are provided.

1203.4 Transoms. In buildings with automatic sprinkler systems of Group R-1, R-2 or R-3, existing transoms in corridors and other fire-resistance-rated walls may be maintained if fixed in the closed position. A sprinkler shall be installed on each side of the transom.

1203.5 Interior finishes. The existing interior finishes shall be accepted where it is demonstrated that they are the historic finishes.

1203.6 Stairway enclosure. In buildings of three stories or less, exit enclosure construction shall limit the spread of smoke by the use of tight-fitting doors and solid elements. Such elements are not required to have a fire-resistance rating.

1203.7 One-hour fire-resistant assemblies. Where 1-hour fire-resistance-rated construction is required by these provisions, it need not be provided, regardless of construction or occupancy, where the existing wall and ceiling finish is wood or metal lath and plaster.

1203.8 Glazing in fire-resistance-rated systems. Historic glazing materials are permitted in interior walls required to have a 1-hour fire-resistance rating where the opening is provided with *approved* smoke seals and the area affected is provided with an automatic sprinkler system.

1203.9 Stairway railings. Grand stairways shall be accepted without complying with the handrail and guard requirements. Existing handrails and guards at all stairways shall be permitted to remain, provided they are not structurally *dangerous*.

1203.10 Guards. Guards shall comply with Sections 1203.10.1 and 1203.10.2.

1203.10.1 Height. Existing guards shall comply with the requirements of Section 404.

1203.10.2 Guard openings. The spacing between existing intermediate railings or openings in existing ornamental patterns shall be accepted. Missing elements or members of a guard may be replaced in a manner that will preserve the historic appearance of the building or structure.

1203.11 Exit signs. Where exit sign or egress path marking location would damage the historic character of the building, alternative exit signs are permitted with approval of the *code official*. Alternative signs shall identify the exits and egress path.

1203.12 Automatic sprinkler systems. Every *historic building* that cannot be made to conform to the construction requirements specified in the *Building Code of New York State* for the occupancy or use and that constitutes a distinct fire hazard shall be deemed to be in compliance if provided with an *approved* automatic sprinkler system.

Exception: Where the *code official* approves an alternative life-safety system.

SECTION 1204—CHANGE OF OCCUPANCY

1204.1 General. *Historic buildings* undergoing a *change of occupancy* shall comply with the applicable provisions of Chapter 10, except as specifically permitted in this chapter. Where Chapter 10 requires compliance with specific requirements of Chapter 7, Chapter 8 or Chapter 9 and where those requirements are subject to the exceptions in Section 1202, the same exceptions shall apply to this section.

1204.2 Building area. The allowable floor area for *historic buildings* undergoing a *change of occupancy* shall be permitted to exceed by 20 percent the allowable areas specified in Chapter 5 of the *Building Code of New York State*.

1204.3 Location on property. Historic structures undergoing a *change of use* to a higher-hazard category in accordance with Section 1011.7 may use alternative methods to comply with the fire-resistance and exterior opening protective requirements. Such alternatives shall comply with Section 1201.2.

1204.4 Occupancy separation. Required occupancy separations of 1 hour may be omitted where the building is provided with an *approved* automatic sprinkler system throughout.

1204.5 Roof covering. Regardless of occupancy or use group, roof-covering materials not less than Class C, where tested in accordance with ASTM E108 or UL 790, shall be permitted where a fire-retardant roof covering is required.

1204.6 Means of egress. Existing door openings and corridor and stairway widths less than those that would be acceptable for nonhistoric buildings under these provisions shall be *approved*, provided that, in the opinion of the *code official*, there is sufficient width and height for a person to pass through the opening or traverse the exit and that the capacity of the exit system is adequate for the occupant load, or where other operational controls to limit occupancy are *approved* by the *code official*.

1204.7 Door swing. Where *approved* by the *code official*, existing front doors need not swing in the direction of exit travel, provided that other *approved* exits having sufficient capacity to serve the total occupant load are provided.

1204.8 Transoms. In corridor walls required by these provisions to be fire-resistance rated, existing transoms may be maintained if fixed in the closed position, and fixed wired glass set in a steel frame or other *approved* glazing shall be installed on one side of the transom.

Exception: Transoms conforming to Section 1203.4 shall be accepted.

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1204.9 Interior finishes. Where interior finish materials are required to comply with the fire test requirements of Section 803.1 of the *Building Code of New York State*, existing nonconforming materials shall be permitted to be surfaced with an *approved* fire-retardant coating to achieve the required classification. Compliance with this section shall be demonstrated by testing the fire-retardant coating on the same material and achieving the required fire classification. Where the same material is not available, it shall be permitted to test on a similar material.

Exception: Existing nonconforming materials need not be surfaced with an *approved* fire-retardant coating where the building is equipped throughout with an automatic sprinkler system installed in accordance with the *Building Code of New York State* and the nonconforming materials can be substantiated as being historic in character.

1204.10 One-hour fire-resistant assemblies. Where 1-hour fire-resistance-rated construction is required by these provisions, it need not be provided, regardless of construction or occupancy, where the existing wall and ceiling finish is wood lath and plaster.

1204.11 Stairways and guards. Existing stairways shall comply with the requirements of these provisions. The *code official* shall grant alternatives for stairways and guards if alternative stairways are found to be acceptable or are judged to meet the intent of these provisions. Existing stairways shall comply with Section 1203.

Exception: For buildings less than 3,000 square feet (279 m^2), existing conditions are permitted to remain at all stairways and guards.

1204.12 Exit signs. The *code official* may accept alternative exit sign locations where the location of such signs would damage the historic character of the building or structure. Such signs shall identify the exits and exit path.

[BS] 1204.13 Exit stair live load. Existing historic stairways in buildings changed to a Group R-1 or R-2 occupancy shall be accepted where it can be shown that the stairway can support a 75-pounds-per-square-foot (366 kg/m^2) live load.

1204.14 Natural light. Where it is determined by the *code official* that compliance with the natural light requirements of Section 1010.1 will lead to loss of historic character or historic materials in the building, the existing level of natural lighting shall be considered to be acceptable.

SECTION 1205—STRUCTURAL

[BS] 1205.1 General. *Historic buildings* shall comply with the applicable structural provisions for the work as classified in Chapter 6.

Exceptions:

1. The *code official* shall be authorized to accept existing floor and previously *approved* live loads and roof live loads and to approve operational controls that limit the live load or roof live load.
2. Regardless of the level of damage, structural *repairs* shall be permitted to return the building to its predamage condition without additional work.

[BS] 1205.2 Dangerous conditions. Conditions determined by the *code official* to be *dangerous* shall be remedied. Work shall not be required beyond what is required to remedy the *dangerous* condition.

SECTION 1206—RELOCATED BUILDINGS

1206.1 Relocated buildings. Foundations of relocated *historic buildings* and structures shall comply with the *Building Code of New York State*. Relocated *historic buildings* shall otherwise be considered a *historic building* for the purposes of this code. Relocated *historic buildings* and structures shall be sited so that exterior wall and opening requirements comply with the *Building Code of New York State* or with the compliance alternatives of this code.

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CHAPTER
13
PERFORMANCE COMPLIANCE METHODS

User notes:

About this chapter: *Chapter 13 allows for existing buildings to be evaluated so as to show that alterations, while not meeting new construction requirements, will improve the current existing situation. Provisions are based on a numerical scoring system involving 21 various safety parameters and the degree of code compliance for each issue.*

SECTION 1301—GENERAL

1301.1 Scope. The provisions of this chapter shall apply to the *alteration*, *addition* and *change of occupancy* of *existing structures*, including historic structures, as referenced in Section 301.3.3. The provisions of this chapter are intended to maintain or increase the current degree of public safety, health and general welfare in *existing buildings* while permitting, *alteration*, *addition* and *change of occupancy* without requiring full compliance with Chapters 6 through 12, except where compliance with the prescriptive method of Chapter 5 or the work area method of other provisions of this code is specifically required in this chapter.

1301.1.1 Compliance with other methods. *Alterations*, *additions* and *changes of occupancy* to *existing structures* shall comply with the provisions of this chapter or with one of the methods provided in Section 301.3.

SECTION 1302—APPLICABILITY

1302.1 General. *Existing buildings* in which there is work involving *additions*, *alterations* or *changes of occupancy* shall be made to conform to the requirements of this chapter or the provisions of Chapters 6 through 12. The provisions of Sections 1302.1.1 through 1302.1.6 shall apply to existing occupancies that will continue to be, or are proposed to be, in Groups A, B, E, F, I-2, M, R and S. These provisions shall also apply to Group U occupancies where such occupancies are undergoing a *change of occupancy* or a partial change in occupancy with separations in accordance with Section 1302.1.2. These provisions shall not apply to buildings with occupancies in Group H, I-1, I-3 or I-4.

1302.1.1 Change in occupancy. Where an *existing building* is changed to a new occupancy classification and this section is applicable, the provisions of this section for the new occupancy shall be used to determine compliance with this code.

1302.1.2 Partial change in occupancy. Where a portion of the building is changed to a new occupancy classification and that portion is separated from the remainder of the building with fire barrier or horizontal assemblies having a fire-resistance rating as required by Table 508.4 of the *Building Code of New York State* or Section R302 of the *Residential Code of New York State* for the separate occupancies, or with *approved* compliance alternatives, the portion changed shall be made to conform to the provisions of this section. Only the portion separated shall be required to be evaluated for compliance.

Where a portion of the building is changed to a new occupancy classification and that portion is not separated from the remainder of the building with fire barriers or horizontal assemblies having a fire-resistance rating as required by Table 508.4 of the *Building Code of New York State* or Section R302 of the *Residential Code of New York State* for the separate occupancies, or with *approved* compliance alternatives, the provisions of this section which apply to each occupancy shall apply to the entire building. Where there are conflicting provisions, those requirements which secure the greater public safety shall apply to the entire building or structure.

1302.1.3 Additions. *Additions* to *existing buildings* shall comply with the requirements of the *Building Code of New York State* or the *Residential Code of New York State* for new construction. The combined height and area of the *existing building* and the new *addition* shall not exceed the height and area allowed by Chapter 5 of the *Building Code of New York State*. Where a fire wall that complies with Section 706 of the *Building Code of New York State* is provided between the *addition* and the *existing building*, the *addition* shall be considered a separate building. Where a new *occupiable roof* is added to a building or structure, the *occupiable roof* shall comply with the provisions of the *Building Code of New York State*.

Exception: In-filling of floor openings and nonoccupiable appendages, such as elevator and exit stairway shafts, shall be permitted beyond that permitted by the *Building Code of New York State*.

1302.1.4 Alterations. An *existing building* or portion thereof shall not be altered in such a manner that results in the building being less safe or sanitary than such building is currently.

Exception: Where the current level of safety or sanitation is proposed to be reduced, the portion altered shall conform to the requirements of the *Building Code of New York State*.

1302.1.5 Escalators. Where escalators are provided in below-grade transportation stations, existing and new escalators shall be permitted to have a clear width of less than 32 inches (815 mm).

1302.1.6 Plumbing fixtures. Plumbing fixtures shall be provided in accordance with Section 1009 for a change of occupancy and Section 808 for *alterations*. Plumbing fixtures for *additions* shall be in accordance with the *Plumbing Code of New York State*.

[NY] 1302.1.7 Carbon monoxide detection and notification. Carbon monoxide detection and notification shall be provided in accordance with Chapter 3 of this code for *existing buildings* undergoing *alterations*, *additions*, or *changes of occupancy*.

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SECTION 1303—ACCEPTANCE

1303.1 General. For *repairs*, *alterations*, *additions* and *changes of occupancy* to *existing buildings* that are evaluated in accordance with this section, compliance with this section shall be accepted by the *code official*.

1303.1.1 Hazards. Where the *code official* determines that an *unsafe* condition exists as provided for in Section 115, such *unsafe* condition shall be abated in accordance with Section 115.

1303.1.2 Compliance with other codes. Buildings that are evaluated in accordance with this section shall comply with the *Fire Code of New York State* and *Property Maintenance Code of New York State*.

[BS] 1303.1.3 Compliance with flood hazard provisions. In *flood hazard areas*, buildings that are evaluated in accordance with this section shall comply with Section 1612 of the *Building Code of New York State*, or Section R306 of the *Residential Code of New York State*, as applicable, if the work covered by this section constitutes *substantial improvement*. If the work covered by this section is a structurally connected horizontal *addition* that does not constitute *substantial improvement*, the *addition* is not required to comply with the flood design requirements for new construction, provided that both of the following apply.

1. The *addition* shall not create or extend any nonconformity of the *existing building* with the flood-resistant construction requirements.
2. The *lowest floor* of the *addition* shall be at or above the lower of the *lowest floor* of the *existing building* or the *lowest floor* elevation required in Section 1612 of the *Building Code of New York State* or Section R306 of the *Residential Code of New York State*, as applicable.

SECTION 1304—INVESTIGATION AND EVALUATION

1304.1 General. For proposed work covered by this chapter, the building owner shall cause the *existing building* to be investigated and evaluated in accordance with the provisions of Sections 1304.1 through 1307.1.

[BS] 1304.1.1 Structural analysis. The owner shall have a structural analysis of the *existing building* made to determine adequacy of structural systems for the proposed *alteration*, *addition* or *change of occupancy*. The analysis shall demonstrate that the building with the work completed is capable of resisting the loads specified in Chapter 16 of the *Building Code of New York State*.

1304.1.2 Submittal. The results of the investigation and evaluation as required in Section 1304.1, along with proposed compliance alternatives, shall be submitted to the *code official*.

1304.1.3 Determination of compliance. The *code official* shall determine whether the *existing building*, with the proposed *addition*, *alteration* or *change of occupancy*, complies with the provisions of this section in accordance with the evaluation process in Sections 1305.1 through 1307.1.

SECTION 1305—SCORING AND EVALUATION

1305.1 Safety categories. The evaluation shall be composed of three categories: fire safety, means of egress and general safety, as defined in Sections 1305.1.1 through 1305.1.3.

1305.1.1 Fire safety. Included within the fire safety category are the structural fire resistance, automatic fire detection, fire alarm, automatic sprinkler system and fire suppression system features of the *facility*.

1305.1.2 Means of egress. Included within the means of egress category are the configuration, characteristics and support features for means of egress in the *facility*.

1305.1.3 General safety. Included within the general safety category are the fire safety parameters and the means of egress parameters.

1305.2 Evaluation process. The evaluation process specified herein shall be followed in its entirety to evaluate *existing buildings* in Groups A, B, E, F, M, R, S and U. For *existing buildings* in Group I-2, the evaluation process specified herein shall be followed and applied to each and every individual smoke compartment. Table 1306.1 shall be utilized for tabulating the results of the evaluation. References to other sections of this code or other codes indicate that compliance with those sections is required in order to gain credit in the evaluation herein outlined. In applying this section to a building with mixed occupancies, where the separation between the mixed occupancies does not qualify for any category indicated in Section 1305.2.16, the score for each occupancy shall be determined, and the lower score determined for each section of the evaluation process shall apply to the entire building or to each smoke compartment for Group I-2 occupancies.

Where the separation between the mixed occupancies qualifies for any category indicated in Section 1305.2.16, the score for each occupancy shall apply to each portion or smoke compartment of the building based on the occupancy of the space.

1305.2.1 Building height and number of stories. The value for building height and number of stories shall be the lesser value determined by the formula in Section 1305.2.1.1. Section 504 of the *Building Code of New York State* shall be used to determine the allowable height and number of stories of the building. Subtract the actual building height from the allowable height and divide by 12.5 feet (3810 mm). Enter the height value and its sign (positive or negative) in Table 1306.1 under Safety Parameter 1305.2.1, Building Height, for fire safety, means of egress and general safety. The maximum score for a building shall be 10.

1305.2.1.1 Height formula. The following formulas shall be used in computing the building height value.

Equation 13-1 $\text{Height value, feet} = \dfrac{(AH) - (EBH)}{12.5} \times CF$

Equation 13-2 Height value, stories = (*AS* – *EBS*) × CF

where:

AH = Allowable height in feet (mm) from Section 504 of the *Building Code of New York State*.

EBH = *Existing building* height in feet (mm).

AS = Allowable height in stories from Section 504 of the *Building Code of New York State*.

EBS = *Existing building* height in stories.

CF = 1 if (*AH*) – (*EBH*) is positive.

CF = Construction-type factor shown in Table 1305.2.6(2) if (*AH*) – (*EBH*) is negative.

Note: Where mixed occupancies are separated and individually evaluated as indicated in Section 1305.2, the values *AH*, *AS*, *EBH* and *EBS* shall be based on the height of the occupancy being evaluated.

1305.2.2 Building area. The value for building area shall be determined by the formula in Section 1305.2.2.2. Section 506 of the *Building Code of New York State* and the formula in Section 1305.2.2.1 shall be used to determine the allowable area of the building. Enter the area value and its sign (positive or negative) in Table 1306.1 under Safety Parameter 1305.2.2, Building Area, for fire safety, means of egress and general safety. In determining the area value, the maximum permitted positive value for area is 50 percent of the fire safety score as listed in Table 1306.2, Mandatory Safety Scores. Group I-2 occupancies shall be scored zero.

1305.2.2.1 Allowable area formula. The following formula shall be used in computing allowable area:

Equation 13-3 $A_a = A_t + (NS \times I_f)$

where:

A_a n= Allowable building area per story (square feet).

A_t = Tabular allowable area factor (NS, S1, S13R, or SM value, as applicable) in accordance with Table 506.2 of the *Building Code of New York State*.

NS = Tabular allowable area factor in accordance with Table 506.2 of the *Building Code of New York State* for a nonsprinklered building (regardless of whether the building is sprinklered).

I_f = Area factor increase due to frontage as calculated in accordance with Section 506.3 of the *Building Code of New York State*.

1305.2.2.2 Area formula. The following formulas shall be used in computing the area value. Equation 13-4 shall be used for a single occupancy buildings and Equation 13-5 shall be used for multiple occupancy buildings. Determine the area value for each occupancy floor area on a floor-by-floor basis. For multiple occupancy, buildings with the minimum area value of the set of values obtained for the particular occupancy shall be used as the area value for that occupancy.

For single occupancy buildings:

Equation 13-4 Area value_i = (Allowable area - Actual area)/1200 square feet

For multiple occupancy buildings:

Equation 13-5 $$\text{Area value}_i = \frac{\text{Allowable area}_i}{1200\,\text{square feet}}\left[1 - \left(\frac{\text{Actual area}_i}{\text{Allowable area}_i} + \ldots + \frac{\text{Actual area}_n}{\text{Allowable area}_n}\right)\right]$$

where:

i = Value for an individual separated occupancy on a floor.

n = Number of separated occupancies on a floor.

1305.2.3 Compartmentation. Evaluate the compartments created by fire barriers or horizontal assemblies which comply with Sections 1305.2.3.2 and 1305.2.3.3and which are exclusive of the wall elements considered under Sections 1305.2.4 and 1305.2.5. Conforming compartments shall be figured as the net area and do not include shafts, chases, stairways, walls or columns. Using Table 1305.2.3, determine the appropriate compartmentation value (CV) and enter that value into Table 1306.1 under Safety Parameter 1305.2.3, Compartmentation, for fire safety, means of egress and general safety.

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TABLE 1305.2.3—COMPARTMENTATION VALUES					
OCCUPANCY	CATEGORIES[a]				
	a	b	c	d	e
A-1, A-3	0	6	10	14	18
A-2	0	4	10	14	18
A-4, B, E, S-2	0	5	10	15	20
F, M, R, S-1	0	4	10	16	22
I-2	0	2	8	10	14

a. For compartment sizes between categories, the compartmentation value shall be obtained by linear interpolation.

1305.2.3.1 Categories. The categories for compartment separations are:

1. Category a—Compartment size of 15,000 square feet (1394 m^2) or more.
2. Category b—Maximum compartment size of 10,000 square feet (929 m^2).
3. Category c—Maximum compartment size of 7,500 square feet (697 m^2).
4. Category d—Maximum compartment size of 5,000 square feet (464 m^2).
5. Category e—Maximum compartment size of 2,500 square feet (232 m^2).

1305.2.3.2 Wall construction. A wall used to create separate compartments shall be a fire barrier conforming to Section 707 of the *Building Code of New York State* with a fire-resistance rating of not less than 2 hours. Where the building is not divided into more than one compartment, the compartment size shall be taken as the total floor area on all floors. Where there is more than one compartment within a story, each compartmented area on such story shall be provided with a horizontal exit conforming to Section 1026 of the *Building Code of New York State*. The fire door serving as the horizontal exit between compartments shall be so installed, fitted and gasketed that such fire door will provide a substantial barrier to the passage of smoke.

1305.2.3.3 Floor/ceiling construction. A floor/ceiling assembly used to create compartments shall conform to Section 711 of the *Building Code of New York State* and shall have a fire-resistance rating of not less than 2 hours.

1305.2.4 Tenant and dwelling unit separations. Evaluate the fire-resistance rating of floors and walls separating tenants, including dwelling units, and not evaluated under Sections 1305.2.3 and 1305.2.5. Group I-2 occupancies shall evaluate the rating of the separations between care recipient sleeping rooms.

Under the categories and occupancies in Table 1305.2.4, determine the appropriate value and enter that value in Table 1306.1 under Safety Parameter 1305.2.4, Tenant and Dwelling Unit Separations, for fire safety, means of egress and general safety. The value shall be zero for single tenant buildings and buildings without dwelling units.

TABLE 1305.2.4—SEPARATION VALUES					
OCCUPANCY	CATEGORIES				
	a	b	c	d	e
A-1	0	0	0	0	1
A-2	-5	-3	0	1	3
R	-4	-2	0	2	4
A-3, A-4, B, E, F, M, S-1	-4	-3	0	2	4
I-2	0	1	2	3	4
S-2	-5	-2	0	2	4

1305.2.4.1 Categories. The categories for tenant and dwelling unit separations are:

1. Category a—No fire partitions; incomplete fire partitions; no doors; doors not self-closing or automatic-closing.
2. Category b—Fire partitions or floor assemblies with less than 1-hour fire-resistance ratings or not constructed in accordance with Section 708 or 711 of the *Building Code of New York State*, respectively.
3. Category c—Fire partitions with 1-hour or greater fire-resistance ratings constructed in accordance with Section 708 of the *Building Code of New York State* and floor assemblies with 1-hour but less than 2-hour fire-resistance ratings constructed in accordance with Section 711 of the *Building Code of New York State* or with only one tenant within the floor area.
4. Category d—Fire barriers with 1-hour but less than 2-hour fire-resistance ratings constructed in accordance with Section 707 of the *Building Code of New York State* and floor assemblies with 2-hour or greater fire-resistance ratings constructed in accordance with Section 711 of the *Building Code of New York State*.

5. Category e—Fire barriers and floor assemblies with 2-hour or greater fire-resistance ratings and constructed in accordance with Sections 707 and 711 of the *Building Code of New York State*, respectively.

1305.2.5 Corridor walls. Evaluate the fire-resistance rating and degree of completeness of walls which create corridors serving the floor and that are constructed in accordance with Section 1020 of the *Building Code of New York State*. This evaluation shall not include the wall elements considered under Sections 1305.2.3 and 1305.2.4. Under the categories and groups in Table 1305.2.5, determine the appropriate value and enter that value into Table 1306.1 under Safety Parameter 1305.2.5, Corridor Walls, for fire safety, means of egress and general safety.

TABLE 1305.2.5—CORRIDOR WALL VALUES

OCCUPANCY	CATEGORIES			
	a	b	c[a]	d[a]
A-1	-10	-4	0	2
A-2	-30	-12	0	2
A-3, F, M, R, S-1	-7	-3	0	2
A-4, B, E, S-2	-5	-2	0	5
I-2	-10	0	1	2

a. Corridors not providing at least one-half the exit access travel distance for all occupants on a floor shall use Category b.

1305.2.5.1 Categories. The categories for corridor walls are:

1. Category a—No fire partitions; incomplete fire partitions; no doors; or doors not self-closing.
2. Category b—Less than 1-hour fire-resistance rating or not constructed in accordance with Section 708.4 of the *Building Code of New York State*.
3. Category c—1-hour to less than 2-hour fire-resistance rating, with doors conforming to Section 716 of the *Building Code of New York State* or corridors as permitted by Section 1020 of the *Building Code of New York State* to be without a fire-resistance rating.
4. Category d—2-hour or greater fire-resistance rating, with doors conforming to Section 716 of the *Building Code of New York State*.

1305.2.6 Vertical openings. Evaluate the fire-resistance rating of interior exit stairways or ramps, hoistways, escalator openings and other shaft enclosures within the building, and openings between two or more floors. Table 1305.2.6(1) contains the appropriate protection values. Multiply that value by the construction-type factor found in Table 1305.2.6(2). Enter the vertical opening value and its sign (positive or negative) in Table 1306.1 under Safety Parameter 1305.2.6, Vertical Openings, for fire safety, means of egress and general safety. If the structure is a one-story building or if all the unenclosed vertical openings within the building conform to the requirements of Section 712 of the *Building Code of New York State*, enter a value of 2. The maximum positive value for this requirement (VO) shall be 2.

TABLE 1305.2.6(1)—VERTICAL OPENING PROTECTION VALUE

PROTECTION	VALUE
None (unprotected opening)	-2 times number of floors connected
Less than 1 hour	-1 times number of floors connected
1 to less than 2 hours	1
2 hours or more	2

TABLE 1305.2.6(2)—CONSTRUCTION-TYPE FACTOR

FACTOR	TYPE OF CONSTRUCTION								
	IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB
	1.2	1.5	2.2	3.5	2.5	3.5	2.3	3.3	7

1305.2.6.1 Vertical opening formula. The following formula shall be used in computing vertical opening value.

Equation 13-6 $VO = PV \times CF$

where:

VO = Vertical opening value. The calculated value shall not be greater than positive 2.0.

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PV = Protection value from Table 1305.2.6(1).

CF = Construction-type factor from Table 1305.2.6(2).

1305.2.7 HVAC systems. Evaluate the ability of the HVAC system to resist the movement of smoke and fire beyond the point of origin. Under the categories in Section 1305.2.7.1, determine the appropriate value and enter that value into Table 1306.1 under Safety Parameter 1305.2.7, HVAC Systems, for fire safety, means of egress and general safety. *Facilities* in Group I-2 occupancies meeting Category a, b or c shall be considered to fail the evaluation.

1305.2.7.1 Categories. The categories for HVAC systems are:

1. Category a—Plenums not in accordance with Section 602 of the *Mechanical Code of New York State*. -10 points.
2. Category b—Air movement in egress elements not in accordance with Section 1020.6 of the *Building Code of New York State*. -5 points.
3. Category c—Both Categories a and b are applicable. -15 points.
4. Category d—Compliance of the HVAC system with Section 1020.6 of the *Building Code of New York State* and Section 602 of the *Mechanical Code of New York State*. 0 points.
5. Category e—Systems serving one story; or a central boiler/chiller system without ductwork connecting two or more stories or where systems have no ductwork. +5 points.

1305.2.8 Automatic fire detection. Evaluate the smoke detection capability based on the location and operation of automatic fire detectors in accordance with the *Mechanical Code of New York State* and Section 907 of the *Building Code of New York State.* Under the categories and occupancies in Table 1305.2.8, determine the appropriate value and enter that value into Table 1306.1 under Safety Parameter 1305.2.8, Automatic Fire Detection, for fire safety, means of egress and general safety. Facilities in Group I-2 occupancies meeting Category a, b or c shall be considered to fail the evaluation.

TABLE 1305.2.8—AUTOMATIC FIRE DETECTION VALUES

OCCUPANCY	CATEGORIES					
	a	b	c	d	e	f
A-1, A-3, F, M, R, S-1	-10	-5	0	2	6	NA
A-2	-25	-5	0	5	9	NA
A-4, B, E, S-2	-4	-2	0	4	8	NA
I-2	NP	NP	NP	4	5	2

NA = Not Applicable.
NP = Not Permitted.

1305.2.8.1 Categories. The categories for automatic fire detection are:

1. Category a—None.
2. Category b—Existing smoke detectors in HVAC systems and maintained in accordance with the *Fire Code of New York State*.
3. Category c—Smoke detectors in HVAC systems. The detectors are installed in accordance with the requirements for new buildings in the *Mechanical Code of New York State*.
4. Category d—Smoke detectors throughout all floor areas other than individual sleeping units, tenant spaces and dwelling units.
5. Category e—Smoke detectors installed throughout the floor area.
6. Category f—Smoke detectors in corridors only.

1305.2.9 Fire alarm systems. Evaluate the capability of the fire alarm system in accordance with Section 907 of the *Building Code of New York State*. Under the categories and occupancies in Table 1305.2.9, determine the appropriate value and enter that value into Table 1306.1 under Safety Parameter 1305.2.9, Fire Alarm System, for fire safety, means of egress and general safety.

TABLE 1305.2.9—FIRE ALARM SYSTEM VALUES

OCCUPANCY	CATEGORIES			
	a	b[a]	c	d
A-1, A-2, A-3, A-4, B, E, R	-10	-5	0	5
F, M, S	0	5	10	15
I-2	-4	1	2	5

a. For buildings equipped throughout with an automatic sprinkler system, add 2 points for activation by a sprinkler water-flow device.

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1305.2.9.1 Categories. The categories for fire alarm systems are:

1. Category a—None.
2. Category b—Fire alarm system with manual fire alarm boxes in accordance with Section 907.4 of the *Building Code of New York State* and alarm notification appliances in accordance with Section 907.5.2 of the *Building Code of New York State*.
3. Category c—Fire alarm system in accordance with Section 907 of the *Building Code of New York State*.
4. Category d—Category c plus a required emergency voice/alarm communications system and a fire command station that conforms to Section 911 of the *Building Code of New York State* and contains the emergency voice/alarm communications system controls, fire department communication system controls, and any other controls specified in Section 911 of the *Building Code of New York State* where those systems are provided.

1305.2.10 Smoke control. Evaluate the ability of a natural or mechanical venting, exhaust or pressurization system to control the movement of smoke from a fire. Under the categories and occupancies in Table 1305.2.10, determine the appropriate value and enter that value into Table 1306.1 under Safety Parameter 1305.2.10, Smoke Control, for means of egress and general safety.

TABLE 1305.2.10—SMOKE CONTROL VALUES

OCCUPANCY	CATEGORIES					
	a	b	c	d	e	f
A-1, A-2, A-3	0	1	2	3	6	6
A-4, E	0	0	0	1	3	5
B, M, R	0	2[a]	3[a]	3[a]	3[a]	4[a]
F, S	0	2[a]	2[a]	3[a]	3[a]	3[a]
I-2	-4	0	0	0	3	0

a. This value shall be 0 if compliance with Category d or e in Section 1305.2.8.1 has not been obtained.

1305.2.10.1 Categories. The categories for smoke control are:

1. Category a—None.
2. Category b—The building is equipped throughout with an automatic sprinkler system. Openings are provided in exterior walls at the rate of 20 square feet (1.86 m^2) per 50 linear feet (15 240 mm) of exterior wall in each story and distributed around the building perimeter at intervals not exceeding 50 feet (15 240 mm). Such openings shall be readily openable from the inside without a key or separate tool and shall be provided with ready access thereto. In lieu of operable openings, clearly and permanently marked tempered glass panels shall be used.
3. Category c—One enclosed exit stairway, with ready access thereto, from each occupied floor of the building. The stairway has operable exterior windows, and the building has openings in accordance with Category b.
4. Category d—One smokeproof enclosure and the building has openings in accordance with Category b.
5. Category e—The building is equipped throughout with an automatic sprinkler system. Each floor area is provided with a mechanical air-handling system designed to accomplish smoke containment. Return and exhaust air shall be moved directly to the outside without recirculation to other floor areas of the building under fire conditions. The system shall exhaust not less than six air changes per hour from the floor area. Supply air by mechanical means to the floor area is not required. Containment of smoke shall be considered as confining smoke to the floor area involved without migration to other floor areas. Any other tested and *approved* design that will adequately accomplish smoke containment is permitted.
6. Category f—Each stairway shall be one of the following: a smokeproof enclosure in accordance with Section 1023.12 of the *Building Code of New York State*; pressurized in accordance with Section 909.20.4 of the *Building Code of New York State*; or shall have operable exterior windows.

1305.2.11 Means of egress capacity and number. Evaluate the means of egress capacity and the number of exits available to the building occupants. In applying this section, the means of egress are required to conform to the following sections of the *Building Code of New York State*: 1003.7, 1004, 1005, 1006, 1007, 1016.2, 1026.1, 1028.3, 1028.5, 1030.2, 1030.3, 1030.4 and 1031. The number of exits credited is the number that is available to each occupant of the area being evaluated. Existing fire escapes shall be accepted as a component in the means of egress when conforming to Section 504.

Under the categories and occupancies in Table 1305.2.11, determine the appropriate value and enter that value into Table 1306.1 under Safety Parameter 1305.2.11, Means of Egress, for means of egress and general safety.

TABLE 1305.2.11—MEANS OF EGRESS VALUES					
OCCUPANCY	CATEGORIES				
	a[a]	b	c	d	e
A-1, A-2, A-3, A-4, E, I-2	-10	0	2	8	10
M	-3	0	1	2	4
B, F, S	-1	0	0	0	0
R	-3	0	0	0	0

a. The values indicated are for buildings six stories or less in height. For buildings over six stories above grade plane, add an additional -10 points.

1305.2.11.1 Categories. The categories for means-of-egress capacity and number of exits are:

1. Category a—Compliance with the minimum required means-of-egress capacity or number of exits is achieved through the use of a fire escape in accordance with Section 504.
2. Category b—Capacity of the means of egress complies with Section 1005 of the *Building Code of New York State*, and the number of exits complies with the minimum number required by Section 1006 of the *Building Code of New York State*.
3. Category c—Capacity of the means of egress is equal to or exceeds 125 percent of the required means-of-egress capacity, the means of egress complies with the minimum required width dimensions specified in the *Building Code of New York State*, and the number of exits complies with the minimum number required by Section 1006 of the *Building Code of New York State*.
4. Category d—The number of exits provided exceeds the number of exits required by Section 1006 of the *Building Code of New York State*. Exits shall be located a distance apart from each other equal to not less than that specified in Section 1007 of the *Building Code of New York State*.
5. Category e—The area being evaluated meets both Categories c and d.

1305.2.12 Dead ends. In spaces required to be served by more than one means of egress, evaluate the length of the exit access travel path in which the building occupants are confined to a single path of travel. Under the categories and occupancies in Table 1305.2.12, determine the appropriate value and enter that value into Table 1306.1 under Safety Parameter 1305.2.12, Dead Ends, for means of egress and general safety.

TABLE 1305.2.12—DEAD-END VALUES				
OCCUPANCY	CATEGORIES[a]			
	a	b	c	d
A-1, A-3, A-4, B, F, M, R, S	-2	0	2	-4
A-2, E	-2	0	2	-4
I-2	-2	0	2	-6

a. For dead-end distances between categories, the dead-end value shall be obtained by linear interpolation.

1305.2.12.1 Categories. The categories for dead ends are:

1. Category a—Dead end of 35 feet (10 670 mm) in nonsprinklered buildings or 70 feet (21 340 mm) in sprinklered buildings.
2. Category b—Dead end of 20 feet (6096 mm); or 50 feet (15 240 mm) in Group B in accordance with Section 1020.5, Exception 2, of the *Building Code of New York State*.
3. Category c—No dead ends; or ratio of length to width (l/w) is less than 2.5:1.
4. Category d—Dead ends exceeding Category a.

1305.2.13 Maximum exit access travel distance to an exit. Evaluate the length of exit access travel to an *approved* exit. Determine the appropriate points in accordance with the following equation and enter that value into Table 1306.1 under Safety Parameter 1305.2.13, Maximum Exit Access Travel Distance, for means of egress and general safety. The maximum allowable exit access travel distance shall be determined in accordance with Section 1017 of the *Building Code of New York State*.

Equation 13-7

$$\text{Points} = 20 \times \frac{\text{Maximum allowable travel distance} - \text{Maximum actual travel distance}}{\text{Maximum allowable travel distance}}$$

1305.2.14 Elevator control. Evaluate the passenger elevator equipment and controls that are available to the fire department to reach all occupied floors. Emergency recall and in-car operation of elevators shall be provided in accordance with the *Fire Code of New York State*. Under the categories and occupancies in Table 1305.2.14, determine the appropriate value and enter that value

into Table 1306.1 under Safety Parameter 1305.2.14, Elevator Control, for fire safety, means of egress and general safety. The values shall be zero for a single-story building.

TABLE 1305.2.14—ELEVATOR CONTROL VALUES

ELEVATOR TRAVEL	CATEGORIES			
	a	b	c	d
Less than 25 feet of travel above or below the primary level of elevator access for emergency fire-fighting or rescue personnel	-2	0	0	+2
Travel of 25 feet or more above or below the primary level of elevator access for emergency fire-fighting or rescue personnel	-4	NP	0	+4

For SI: 1 foot = 304.8 mm.
NP = Not Permitted.

1305.2.14.1 Categories. The categories for elevator controls are:

1. Category a—No elevator.
2. Category b—Any elevator without Phase I emergency recall operation and Phase II emergency in-car operation.
3. Category c—All elevators with Phase I emergency recall operation and Phase II emergency in-car operation as required by the *Fire Code of New York State*.
4. Category d—All meet Category c; or Category b where permitted to be without Phase I emergency recall operation and Phase II emergency in-car operation; and at least one elevator that complies with new construction requirements serves all occupied floors.

1305.2.15 Means of egress emergency lighting. Evaluate the presence of and reliability of means of egress emergency lighting. Under the categories and occupancies in Table 1305.2.15, determine the appropriate value and enter that value into Table 1306.1 under Safety Parameter 1305.2.15, Means of Egress Emergency Lighting, for means of egress and general safety.

TABLE 1305.2.15—MEANS OF EGRESS EMERGENCY LIGHTING VALUES

NUMBER OF EXITS REQUIRED BY SECTION 1006 OF THE *Building Code of New York State*	CATEGORIES		
	a	b	c
Two or more exits	NP	0	4
Minimum of one exit	0	1	1

NP = Not Permitted.

1305.2.15.1 Categories. The categories for means of egress emergency lighting are:

1. Category a—Means-of-egress lighting and exit signs not provided with emergency power in accordance with Section 2702 of the *Building Code of New York State*.
2. Category b—Means of egress lighting and exit signs provided with emergency power in accordance with Section 2702 of the *Building Code of New York State*.
3. Category c—Emergency power provided to means of egress lighting and exit signs, which provides protection in the event of power failure to the site or building.

1305.2.16 Mixed occupancies. Where a building has two or more occupancies that are not in the same occupancy classification, the separation between the mixed occupancies shall be evaluated in accordance with this section. Where there is no separation between the mixed occupancies or the separation between mixed occupancies does not qualify for any of the categories indicated in Section 1305.2.16.1, the building shall be evaluated as indicated in Section 1305.2, and the value for mixed occupancies shall be zero. Under the categories and occupancies in Table 1305.2.16, determine the appropriate value and enter that value into Table 1306.1 under Safety Parameter 1305.2.16, Mixed Occupancies, for fire safety and general safety. For buildings without mixed occupancies, the value shall be zero. Facilities in Group I-2 occupancies meeting Category a shall be considered to fail the evaluation.

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TABLE 1305.2.16—MIXED OCCUPANCY VALUES[a]			
OCCUPANCY	CATEGORIES		
	a	b	c
A-1, A-2, R	-10	0	10
A-3, A-4, B, E, F, M, S	-5	0	5
I-2	NP	0	5

NP = Not Permitted.
a. For fire-resistance ratings between categories, the value shall be obtained by linear interpolation.

1305.2.16.1 Categories. The categories for mixed occupancies are:

1. Category a—Occupancies separated by minimum 1-hour fire barriers or minimum 1-hour horizontal assemblies, or both.
2. Category b—Separations between occupancies in accordance with Section 508.4 of the *Building Code of New York State*.
3. Category c—Separations between occupancies having a fire-resistance rating of not less than twice that required by Section 508.4 of the *Building Code of New York State*.

1305.2.17 Automatic sprinklers. Evaluate the ability to suppress or control a fire based on the installation of an automatic sprinkler system in accordance with Section 903.3.1 of the *Building Code of New York State*. "Required sprinklers" shall be based on the requirements of the *Building Code of New York State*. Under the categories and occupancies in Table 1305.2.17, determine the appropriate value and enter that value into Table 1306.1 under Safety Parameter 1305.2.17, Automatic Sprinklers, for fire safety, means of egress divided by 2, and general safety. High-rise buildings defined in Chapter 2 of the *Building Code of New York State* that undergo a *change of occupancy* to Group R shall be equipped throughout with an automatic sprinkler system in accordance with Section 403 of the *Building Code of New York State* and Chapter 9 of the *Building Code of New York State*. Facilities in Group I-2 occupancies meeting Category a, b, c or f shall be considered to fail the evaluation.

TABLE 1305.2.17—SPRINKLER SYSTEM VALUES						
OCCUPANCY	CATEGORIES					
	a[a]	b[a]	c	d	e	f
A-1, A-3, F, M, R, S-1	-6	-3	0	2	4	6
A-2	-4	-2	0	1	2	4
A-4, B, E, S-2	-12	-6	0	3	6	12
I-2	NP	NP	NP	8	10	NP

NP = Not Permitted.
a. These options cannot be taken if Category a in Section 1305.2.18 is used.

1305.2.17.1 Categories. The categories for automatic sprinkler system protection are:

1. Category a—An *approved* automatic sprinkler system is required throughout; an *approved* automatic sprinkler system is not provided.
2. Category b—An *approved* automatic sprinkler system is required in a portion of a building; an *approved* automatic sprinkler system is not provided; the sprinkler system design is not adequate for the hazard protected in accordance with Chapter 9 of the *Building Code of New York State*.
3. Category c—An *approved* automatic sprinkler system is not required; none are provided.
4. Category d—An *approved* automatic sprinkler system is required in a portion of a building; an *approved* automatic sprinkler system is provided in a portion of a building in accordance with Chapter 9 of the *Building Code of New York State*.
5. Category e—An *approved* automatic sprinkler system is required throughout; an *approved* automatic sprinkler system is provided throughout in accordance with Chapter 9 of the *Building Code of New York State*.
6. Category f—An *approved* automatic sprinkler system is not required throughout; an *approved* automatic sprinkler system is provided throughout in accordance with Chapter 9 of the *Building Code of New York State*.

1305.2.18 Standpipes. Evaluate the ability to initiate attack on a fire by making a supply of water readily available through the installation of standpipes in accordance with Section 905 of the *Building Code of New York State*. "Required Standpipes" shall be based on the requirements of the *Building Code of New York State*. Under the categories and occupancies in Table 1305.2.18, determine the appropriate value and enter that value into Table 1306.1 under Safety Parameter 1305.2.18, Standpipes, for fire safety, means of egress and general safety.

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TABLE 1305.2.18—STANDPIPE SYSTEM VALUES				
OCCUPANCY	CATEGORIES			
	a[a]	b	c	d
A-1, A-3, F, M, R, S-1	-6	0	4	6
A-2	-4	0	2	4
A-4, B, E, S-2	-12	0	6	12
I-2	-2	0	1	2

a. This option cannot be taken if Category a or Category b in Section 1305.2.17 is used.

1305.2.18.1 Standpipe categories. The categories for standpipe systems are:

1. Category a—Standpipes are required; standpipe is not provided or the standpipe system design is not in compliance with Section 905.3 of the *Building Code of New York State*.
2. Category b—Standpipes are not required; none are provided.
3. Category c—Standpipes are required; standpipes are provided in accordance with Section 905 of the *Building Code of New York State*.
4. Category d—Standpipes are not required; standpipes are provided in accordance with Section 905 of the *Building Code of New York State*.

1305.2.19 Incidental uses. Evaluate the protection of incidental uses in accordance with Section 509.4.2 of the *Building Code of New York State*. Do not include those where this code requires automatic sprinkler systems throughout the building including covered and open mall buildings, high-rise buildings, public garages and unlimited area buildings. Assign the lowest score from Table 1305.2.19 for the building or floor area being evaluated and enter that value into Table 1306.1 under Safety Parameter 1305.2.19, Incidental Use, for fire safety, means of egress and general safety. If there are no specific occupancy areas in the building or floor area being evaluated, the value shall be zero.

TABLE 1305.2.19—INCIDENTAL USE AREA VALUES							
PROTECTION REQUIRED BY TABLE 509.1 OF THE BUILDING CODE OF NEW YORK STATE	PROTECTION PROVIDED						
	None	1 hour	AS	AS with CRS	1 hour and AS	2 hours	2 hours and AS
2 hours and AS	-4	-3	-2	-2	-1	-2	0
2 hours, or 1 hour and AS	-3	-2	-1	-1	0	0	0
1 hour and AS	-3	-2	-1	-1	0	-1	0
1 hour	-1	0	-1	-1	0	0	0
1 hour, or AS with CRS	-1	0	-1	-1	0	0	0
AS with CRS	-1	-1	-1	-1	0	-1	0
1 hour or AS	-1	0	0	0	0	0	0

AS = Automatic Sprinkler System.
CRS = Construction capable of resisting the passage of smoke. (See Section 509.4.2 of the *Building Code of New York State.*)

1305.2.20 Smoke compartmentation. Evaluate the smoke compartments for compliance with Section 407.5 of the *Building Code of New York State*. Under the categories and occupancies in Table 1305.2.20, determine the appropriate smoke compartmentation value (SCV) and enter that value into Table 1306.1 under Safety Parameter 1305.2.20, Smoke Compartmentation, for fire safety, means of egress and general safety. Facilities in Group I-2 occupancies meeting Category b or c shall be considered to fail the evaluation.

TABLE 1305.2.20—SMOKE COMPARTMENTATION VALUES			
OCCUPANCY	CATEGORIES[a]		
	a	b	c
A, B, E, F, M, R and S	0	0	0
I-2	0	-10	NP

NP = Not Permitted.
a. For areas between categories, the smoke compartmentation value shall be obtained by linear interpolation.

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1305.2.20.1 Categories. Categories for smoke compartment size are:

1. Category a—Smoke compartment complies with Section 407.5 of the *Building Code of New York State*.
2. Category b—Smoke compartment are provided but do not comply with Section 407.5 of the *Building Code of New York State*.
3. Category c—Smoke compartments are not provided.

1305.2.21 Care recipient ability, concentration, smoke compartment location and ratio to attendant. In I-2 occupancies, the ability of care recipients, their concentration and ratio to attendants shall be evaluated and applied in accordance with this section. Evaluate each smoke compartment using the categories in Sections 1305.2.21.1, 1305.2.21.2 and 1305.2.21.3 and enter the value in Table 1306.1. To determine the safety factor, multiply the three values together; if the product is less than 6, compliance has failed.

1305.2.21.1 Care recipient ability for self-preservation. Evaluate the ability of the care recipients for self-preservation in each smoke compartment in an emergency. Under the categories and occupancies in Table 1305.2.21.1, determine the appropriate value and enter that value in Table 1306.1 under Safety Parameter 1305.2.21.1, Care Recipient Ability for Self-preservation, for means of egress and general safety.

TABLE 1305.2.21.1—CARE RECIPIENT ABILITY VALUES

OCCUPANCY	CATEGORIES		
	a	b	c
I-2	3	2	1

1305.2.21.1.1 Categories. The categories for care recipient ability for self-preservation are:

1. Category a—(mobile) Care recipients are capable of self-preservation without assistance.
2. Category b—(not mobile) Care recipients rely on assistance for evacuation or relocation.
3. Category c—(not movable) Care recipients cannot be evacuated or relocated.

1305.2.21.2 Care recipient concentration. Evaluate the concentration of care recipients in each smoke compartment under Section 1305.2.21.2. Under the categories and occupancies in Table 1305.2.21.2 determine the appropriate value and enter that value in Table 1306.1 under Safety Parameter 1305.2.21.2, Care Recipient Concentration, for means of egress and general safety.

TABLE 1305.2.21.2—CARE RECIPIENT CONCENTRATION VALUES

OCCUPANCY	CATEGORIES		
	a	b	c
I-2	3	2	1

1305.2.21.2.1 Categories: The categories for care recipient concentration are:

1. Category a—smoke compartment has 1 to 10 care recipients.
2. Category b—smoke compartment has more than 10 to 40 care recipients.
3. Category c—smoke compartment has more than 40 care recipients.

1305.2.21.3 Attendant-to-care recipients ratio. Evaluate the attendant-to-care recipients ratio for each compartment under Section 1305.2.21.3. Under the categories and occupancies in Table 1305.2.21.3 determine the appropriate value and enter that value in Table 1306.1 under Safety Parameter 1305.2.21.3, Attendant-to-Care Recipients Ratio, for means of egress and general safety.

TABLE 1305.2.21.3—ATTENDANT-TO-CARE RECIPIENTS RATIO VALUES

OCCUPANCY	CATEGORIES		
	a	b	c
I-2	3	2	1

1305.2.21.3.1 Categories. The categories for attendant-to-care recipient concentrations are:

1. Category a—attendant-to-care recipients concentration is 1:5 or no care recipients.
2. Category b—attendant-to-care recipients concentration is 1:6 to 1:10.
3. Category c—attendant-to-care recipients concentration is greater than 1:10.

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SECTION 1306—BUILDING SCORE

1306.1 Scoring process. After determining the appropriate data from Section 1305.2, enter those data in Table 1306.1 and total the building score.

TABLE 1306.1—SUMMARY SHEET—BUILDING CODE

Existing occupancy:_____		Proposed occupancy: _____	
Year building was constructed: _____		Number of stories: _____ Height in feet: _____	
Type of construction: _____		Area per floor: _____	
Percentage of open perimeter increase: _____ %			
Completely suppressed:	Yes _____No _____	Corridor wall rating:_____	
		Type:_____	
Compartmentation:	Yes _____No _____	Required door closers:	Yes _____No _____
Fire-resistance rating of vertical opening enclosures: _____			
Type of HVAC system:_____, serving number of floors: _____			
Automatic fire detection:	Yes _____No _____	Type and location: _____	
Fire alarm system:	Yes _____No _____	Type: _____	
Smoke control:	Yes _____No _____	Type: _____	
Adequate exit routes:	Yes _____No _____	Dead ends: _____	Yes _____No _____
Maximum exit access travel distance: _____		Elevator controls:	Yes _____No _____
Means of egress emergency lighting:	Yes _____No _____	Mixed occupancies:	Yes _____No _____
Standpipes:	Yes _____No _____	Care recipients ability for self-preservation: _____	
Incidental use:	Yes _____No _____	Care recipients concentration: _____	
Smoke compartmentation less than 22,500 ft^2 (2092 m^2):	Yes _____No _____	Attendant-to-care recipients ratio: _____	

SAFETY PARAMETERS	FIRE SAFETY (FS)	MEANS OF EGRESS (ME)	GENERAL SAFETY (GS)
1305.2.1 Building height			
1305.2.2 Building area			
1305.2.3 Compartmentation			
1305.2.4 Tenant and dwelling unit separations			
1305.2.5 Corridor walls			
1305.2.6 Vertical openings			
1305.2.7 HVAC systems			
1305.2.8 Automatic fire detection			
1305.2.9 Fire alarm system			
1305.2.10 Smoke control	* * * *		
1305.2.11 Means of egress	* * * *		
1305.2.12 Dead ends	* * * *		
1305.2.13 Maximum exit access travel distance	* * * *		
1305.2.14 Elevator control			
1305.2.15 Means of egress emergency lighting	* * * *		
1305.2.16 Mixed occupancies		* * * *	
1305.2.17 Automatic sprinklers		÷ 2 =	
1305.2.18 Standpipes			
1305.2.19 Incidental use			
1305.2.20 Smoke compartmentation			

TABLE 1306.1—SUMMARY SHEET—BUILDING CODE—continued			
1305.2.21.1 Care recipients ability for self-preservation[a]	* * * *		
1305.2.21.2 Care recipients concentration[a]	* * * *		
1305.2.21.3 Attendant-to-care recipients ratio[a]	* * * *		
Building score–total value			

* * * *No applicable value to be inserted.
a. Only applicable to Group I-2 occupancies.

1306.2 Safety scores. The values in Table 1306.2 are the required mandatory safety scores for the evaluation process listed in Section 1305.2.

TABLE 1306.2—MANDATORY SAFETY SCORES[a]			
OCCUPANCY	**FIRE SAFETY(MFS)**	**MEANS OF EGRESS (MME)**	**GENERAL SAFETY (MGS)**
A-1	20	31	31
A-2	21	32	32
A-3	22	33	33
A-4, E	29	40	40
B	30	40	40
F	24	34	34
I-2	19	34	34
M	23	40	40
R	21	38	38
S-1	19	29	29
S-2	29	39	39

a. MFS = Mandatory Fire Safety.
MME = Mandatory Means of Egress.
MGS = Mandatory General Safety.

SECTION 1307—EVALUATION OF BUILDING SAFETY

1307.1 Final safety score. The mandatory safety score in Table 1306.2 shall be subtracted from the building score in Table 1306.1 for each category in accordance with the evaluation formulas in Table 1307.1. Where the final score for any category equals zero or more, the building is in compliance with the requirements of this section for that category. Where the final score for any category is less than zero, the building is not in compliance with the requirements of this section.

TABLE 1307.1—EVALUATION FORMULAS[a]						
FORMULA	**TABLE 1306.1**	**TABLE 1306.2**		**SCORE**	**PASS**	**FAIL**
FS – MFS ≥ 0	_____(FS) –	_____(MFS)	=	_____	_____	_____
ME – MME ≥ 0	_____(ME) –	_____(MME)	=	_____	_____	_____
GS – MGS ≥ 0	_____(GS) –	_____(MGS)	=	_____	_____	_____

a. FS = Fire Safety.
ME = Means of Egress.
GS = General Safety.
MFS = Mandatory Fire Safety.
MME = Mandatory Means of Egress.
MGS = Mandatory General Safety.

1307.1.1 Mixed occupancies. For mixed occupancies, the following provisions shall apply:

1. Where the separation between mixed occupancies does not qualify for any category indicated in Section 1305.2.16, the mandatory safety scores for the occupancy with the lowest general safety score in Table 1306.2 shall be utilized (see Section 1305.2).

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2. Where the separation between mixed occupancies qualifies for any category indicated in Section 1305.2.16, the mandatory safety scores for each occupancy shall be placed against the evaluation scores for the appropriate occupancy. An evaluation is not required for areas of the building with separated occupancies in accordance with Table 508.4 of the *Building Code of New York State* in which there are no *alterations* or *change of occupancy*.

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CHAPTER

14

RELOCATED OR MOVED BUILDINGS

User notes:

About this chapter: *Chapter 14 is applicable to any building that is moved or relocated. The relocation of a building will automatically cause an inspection and evaluation process that enables the jurisdiction to determine the level of compliance with the Fire Code of New York State and the Property Maintenance Code of New York State. These two codes, by their scope, are applicable to existing buildings. This is the case regardless of any repair, remodeling, alteration work or change of occupancy occurring (see the Fire Code of New York State and Property Maintenance Code of New York State).*

SECTION 1401—GENERAL

1401.1 Scope. This chapter provides requirements for relocated or moved structures, including *relocatable buildings* as defined in Chapter 2.

1401.1.1 Bleachers, folding and telescopic seating and grandstands. Relocated or moved bleachers, folding and telescopic seating and grandstands shall comply with ICC 300.

1401.2 Conformance. The building shall be safe for human occupancy as determined by the *Fire Code of New York State* and the *Property Maintenance Code of New York State* . Any *repair, alteration* or *change of occupancy* undertaken within the moved structure shall comply with the requirements of this code applicable to the work being performed. Any field-fabricated elements shall comply with the requirements of the *Building Code of New York State* or the *Residential Code of New York State*, as applicable.

SECTION 1402—REQUIREMENTS

1402.1 Location on the lot. The building shall be located on the lot in accordance with the requirements of the *Building Code of New York State* or the *Residential Code of New York State*, as applicable.

[BS] 1402.2 Foundation. The foundation system of relocated buildings shall comply with the *Building Code of New York State* or the *Residential Code of New York State*, as applicable.

[BS] 1402.2.1 Connection to the foundation. The connection of the relocated building to the foundation shall comply with the *Building Code of New York State* or the *Residential Code of New York State*, as applicable.

[BS] 1402.3 Wind loads. Buildings shall comply with *Building Code of New York State* or *Residential Code of New York State* wind provisions, as applicable.

Exceptions:

1. Detached one- and two-family dwellings and Group U occupancies where wind loads at the new location are not higher than those at the previous location.
2. Structural elements whose stress is not increased by more than 10 percent.

[BS] 1402.4 Seismic loads. Buildings shall comply with *Building Code of New York State* or *Residential Code of New York State* seismic provisions at the new location, as applicable.

Exceptions:

1. Structures in Seismic Design Categories A and B and detached one- and two-family dwellings in Seismic Design Categories A, B and C where the seismic loads at the new location are not higher than those at the previous location.
2. Structural elements whose stress is not increased by more than 10 percent.

[BS] 1402.5 Snow loads. Structures shall comply with *Building Code of New York State* or *Residential Code of New York State* snow loads, as applicable, where snow loads at the new location are higher than those at the previous location.

Exception: Structural elements whose stress is not increased by more than 5 percent.

[BS] 1402.6 Flood hazard areas. If relocated or moved into a *flood hazard area*, structures shall comply with Section 1612 of the *Building Code of New York State*, or Section R306 of the *Residential Code of New York State*, as applicable.

[BS] 1402.7 Required inspection and repairs. The *code official* shall be authorized to inspect, or to require *approved* professionals to inspect at the expense of the owner, the various structural parts of a relocated building to verify that structural components and connections have not sustained structural damage. Any *repairs* required by the *code official* as a result of such inspection shall be made prior to the final approval.

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CHAPTER

15 CONSTRUCTION SAFEGUARDS

User notes:

About this chapter: *Chapter 15 looks to the construction process. Parameters are provided for demolition and for protecting adjacent property during demolition and construction. Issues such as how to provide egress and adequate water supply while the building is growing, the timing of standpipe and sprinkler installation, and protection of pedestrians are addressed. Note that this chapter is consistent with Chapter 33 of the Building Code of New York State and Chapter 33 of the Fire Code of New York State.*

SECTION 1501—GENERAL

[BG] 1501.1 Scope. The provisions of this chapter shall govern safety during construction and the protection of adjacent public and private properties. Fire safety during construction shall also comply with the applicable provisions of Chapter 33 of the *Fire Code of New York State.*

[BG] 1501.2 Storage and placement of construction equipment and materials. Construction equipment and materials shall be stored and placed so as not to endanger the public, the workers or adjoining property for the duration of the construction project.

[BS] 1501.3 Roof loads. Structural roof components shall be capable of supporting the roof-covering system and the material and equipment loads that will be encountered during installation of the system.

[BG] 1501.4 Maintenance of exits, existing structural elements, fire protection devices and sanitary safeguards. Required exits, existing structural elements, fire protection devices and sanitary safeguards shall be maintained at all times during *alterations*, *repairs* or *additions* to any building or structure.

Exceptions:

1. Where such required elements or devices are being altered or repaired, adequate substitute provisions shall be made.
2. Maintenance of such elements and devices is not required where the *existing building* is not occupied.

[BG] 1501.5 Removal of waste materials. Waste materials shall be removed in a manner that prevents injury or damage to persons, adjoining properties and public rights-of-way.

SECTION 1502—OWNER'S RESPONSIBILITY FOR FIRE PROTECTION

[F] 1502.1 Site safety plan. The owner or owner's authorized agent shall be responsible for the development, implementation and maintenance of an *approved*, written site safety plan establishing a fire prevention program at the project site applicable throughout all phases of the construction, *repair*, *alteration* or demolition work. The plan shall be submitted and *approved* before a building permit is issued, Any changes to the plan shall address the requirements of this chapter and other applicable portions of the *Fire Code of New York State*, the duties of staff and staff training requirements. The plan shall be submitted for approval in accordance with the *Fire Code of New York State*.

[F] 1502.1.1 Components of site safety plans. Site safety plans shall include the following as applicable:

1. Name and contact information of site safety director.
2. Documentation of the training of the site safety director and fire watch personnel.
3. Procedures for reporting emergencies.
4. Fire department vehicle access routes.
5. Location of fire protection equipment, including portable fire extinguishers, standpipes, fire department connections and fire hydrants.
6. Smoking and cooking policies, designated areas to be used where approved and signage locations in accordance with the *Fire Code of New York State*.
7. Location and safety considerations for temporary heating equipment.
8. Hot work permit plan.
9. Plans for control of combustible waste material.
10. Locations and methods for storage and use of flammable and combustible liquids and other hazardous materials.
11. Provisions for site security and, where required, for a fire watch.
12. Changes that affect this plan.
13. Other site-specific information required by the *Fire Code of New York State*.

[F] 1502.2 Site safety director. The owner shall designate a person to be the site safety director. The site safety director shall be responsible for ensuring compliance with the site safety plan. The site safety director shall have the authority to enforce the provisions of this chapter and other provisions as necessary to secure the intent of this chapter. Where guard service is provided in accordance with the *Fire Code of New York State*, the site safety director shall be responsible for the guard service.

[F] 1502.3 Daily fire safety inspection. The site safety director shall be responsible for completion of a daily fire safety inspection at the project site. Each day, all building and outdoor areas shall be inspected to ensure compliance with the inspection list in this

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section. The results of each inspection shall be documented and maintained on-site until a certificate of occupancy has been issued. Documentation shall be immediately available on-site for inspection and review.

1. Any contractors entering the site to perform hot work each day have been instructed in the hot work safety requirements in the *Fire Code of New York State*, and hot work is performed only in areas approved by the site safety director.
2. Temporary heating equipment is maintained away from combustible materials in accordance with the equipment manufacturer's instructions.
3. Combustible debris, rubbish and waste material is removed from the building in areas where work is not being performed.
4. Temporary wiring does not have exposed conductors.
5. Flammable liquids and other hazardous materials are stored in locations that have been approved by the site safety director when not involved in work that is being performed.
6. Fire apparatus access roads required by the *Fire Code of New York State* are maintained clear of obstructions that reduce the width of the usable roadway to less than 20 feet (6096 mm).
7. Fire hydrants are clearly visible from access roads and are not obstructed.
8. The location of fire department connections to standpipe and in-service sprinkler systems are clearly identifiable from the access road and such connections are not obstructed.
9. Standpipe systems are in service and continuous to the highest work floor, as specified in Section 1509.
10. Portable fire extinguishers are available in locations required by Section 1507 and for roofing operations in accordance with the *Fire Code of New York State*.
11. Where a fire watch is required, fire watch records complying with the *Fire Code of New York State* are up-to-date.

[F] 1502.3.1 Violations. Failure to properly conduct, document and maintain documentation required by this section shall constitute an unlawful act in accordance with Section 113.1 and shall result in the issuance of a notice of violation to the site safety director in accordance with Section 113.2. Upon the third offense, the *code official* is authorized to issue a stop work order in accordance with Section 114, and work shall not resume until satisfactory assurances of future compliance have been presented to and *approved* by the *code official*.

SECTION 1503—SANITARY

[BG] 1503.1 Facilities required. Sanitary facilities shall be provided during construction or demolition activities in accordance with the *Plumbing Code of New York State*.

SECTION 1504—PROTECTION OF PEDESTRIANS

[BS] 1504.1 Protection of pedestrians. Pedestrians shall be protected during construction and demolition activities as required by Sections 1504.1.1 through 1504.1.7 and Table 1504.1. Signs shall be provided to direct pedestrian traffic.

TABLE 1504.1—PROTECTION OF PEDESTRIANS

HEIGHT OF CONSTRUCTION	DISTANCE OF CONSTRUCTION TO LOT LINE	TYPE OF PROTECTION REQUIRED
8 feet or less	Less than 5 feet	Construction railings
	5 feet or more	None
More than 8 feet	Less than 5 feet	Barrier and covered walkway
	5 feet or more, but not more than one-fourth the height of construction	Barrier and covered walkway
	5 feet or more, but between one-fourth and one-half the height of construction	Barrier
	5 feet or more, but exceeding one-half the height of construction	None

For SI: 1 foot = 304.8 mm.

[BS] 1504.1.1 Walkways. A walkway shall be provided for pedestrian travel in front of every construction and demolition site unless the applicable governing authority authorizes the sidewalk to be fenced or closed. A walkway shall be provided for pedestrian travel that leads from a building entrance or exit of an occupied structure to a public way. Walkways shall be of sufficient width to accommodate the pedestrian traffic, but shall be not less than 4 feet (1219 mm) in width. Walkways shall be provided with a durable walking surface and shall be accessible in accordance with Chapter 11 of the *Building Code of New York State*. Walkways shall be designed to support all imposed loads and the design live load shall be not less than 150 pounds per square foot (psf) (7.2 kN/m^2).

[BS] 1504.1.2 Directional barricades. Pedestrian traffic shall be protected by a directional barricade where the walkway extends into the street. The directional barricade shall be of sufficient size and construction to direct vehicular traffic away from the pedestrian path.

[BS] 1504.1.3 Construction railings. Construction railings shall be not less than 42 inches (1067 mm) in height and shall be sufficient to direct pedestrians around construction areas.

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[BS] 1504.1.4 Barriers. Barriers shall be not less than 8 feet (2438 mm) in height and shall be placed on the side of the walkway nearest the construction. Barriers shall extend the entire length of the construction site. Openings in such barriers shall be protected by doors that are normally kept closed.

[BS] 1504.1.4.1 Barrier design. Barriers shall be designed to resist loads required in Chapter 16 of the *Building Code of New York State* unless constructed as follows:

1. Barriers shall be provided with 2-inch by 4-inch (51 mm by 102 mm) top and bottom plates.
2. The barrier material shall be boards not less than $^{3}/_{4}$ inch (19.1 mm) in thickness or wood structural use panels not less than $^{1}/_{4}$ inch (6.4 mm) in thickness.
3. Wood structural use panels shall be bonded with an adhesive identical to that for exterior wood structural use panels.
4. Wood structural use panels $^{1}/_{4}$ inch (6.4 mm) or $^{15}/_{16}$ inch (23.8 mm) in thickness shall have studs spaced not more than 2 feet (610 mm) on center.
5. Wood structural use panels $^{3}/_{8}$ inch (9.5 mm) or $^{1}/_{2}$ inch (12.7 mm) in thickness shall have studs spaced not more than 4 feet (1219 mm) on center, provided that a 2-inch by 4-inch (51 mm by 102 mm) stiffener is placed horizontally at mid-height where the stud spacing is greater than 2 feet (610 mm) on center.
6. Wood structural use panels $^{5}/_{8}$ inch (15.9 mm) or thicker shall not span over 8 feet (2438 mm).

[BS] 1504.1.5 Covered walkways. Covered walkways shall have a clear height of not less than 8 feet (2438 mm) as measured from the floor surface to the canopy overhead. Adequate lighting shall be provided at all times. Covered walkways shall be designed to support all imposed loads. The design live load shall be not less than 150 psf (7.2 kN/m^2) for the entire structure.

Exception: Roofs and supporting structures of covered walkways for new, light-frame construction not exceeding two stories above grade plane are permitted to be designed for a live load of 75 psf (3.6 kN/m^2) or the loads imposed on them, whichever is greater. In lieu of such designs, the roof and supporting structure of a covered walkway are permitted to be constructed as follows:

1. Footings shall be continuous 2-inch by 6-inch (51 mm by 152 mm) members.
2. Posts not less than 4 inches by 6 inches (102 mm by 152 mm) shall be provided on both sides of the roof and spaced not more than 12 feet (3658 mm) on center.
3. Stringers not less than 4 inches by 12 inches (102 mm by 305 mm) shall be placed on edge on the posts.
4. Joists resting on the stringers shall be not less than 2 inches by 8 inches (51 mm by 203 mm) and shall be spaced not more than 2 feet (610 mm) on center.
5. The deck shall be planks not less than 2 inches (51 mm) thick or wood structural panels with an exterior exposure durability classification not less than $^{23}/_{32}$ inch (18.3 mm) thick nailed to the joists.
6. Each post shall be knee-braced to joists and stringers by members not less than 2 inches by 4 inches (51 mm by 102 mm); 4 feet (1219 mm) in length.
7. A curb that is not less than 2 inches by 4 inches (51 mm by 102 mm) shall be set on edge along the outside edge of the deck.

[BS] 1504.1.6 Repair, maintenance and removal. Pedestrian protection required by Section 1504.1 shall be maintained in place and kept in good order for the entire length of time pedestrians are subject to being endangered. The owner or the owner's authorized agent, on completion of the construction activity, shall immediately remove walkways, debris and other obstructions and leave such public property in as good a condition as it was before such work was commenced.

[BS] 1504.1.7 Adjacent to excavations. Every excavation on a site located 5 feet (1524 mm) or less from the street lot line shall be enclosed with a barrier not less than 6 feet (1829 mm) in height. Where located more than 5 feet (1524 mm) from the street lot line, a barrier shall be erected where required by the *code official*. Barriers shall be of adequate strength to resist wind pressure as specified in Chapter 16 of the *Building Code of New York State*.

SECTION 1505—PROTECTION OF ADJOINING PROPERTY

[BS] 1505.1 Protection required. Adjoining public and private property shall be protected from damage during construction and demolition work. Protection must be provided for footings, foundations, party walls, chimneys, skylights and roofs. Provisions shall be made to control water runoff and erosion during construction or demolition activities. The person making or causing an excavation to be made shall provide written notice to the owners of adjoining buildings advising them that the excavation is to be made and that the adjoining buildings should be protected. Said notification shall be delivered not less than 10 days prior to the scheduled starting date of the excavation.

[BS] 1505.2 Excavation retention systems. Where a retention system is used to provide support of an excavation for protection of adjacent structures, the system shall conform to the requirements in Section 1505.2.1 through 1505.2.3.

[BS] 1505.2.1 Excavation retention system design. Excavation retention systems shall be designed by a *registered design professional* to provide vertical and lateral support.

[BS] 1505.2.2 Excavation retention system monitoring. The retention system design shall include requirements for monitoring of the system and adjacent structures for horizontal and vertical movement.

[BS] 1505.2.3 Retention system removal. Elements of the system shall only be removed or decommissioned where adequate replacement support is provided by backfill or by the new structure. Removal or decommissioning shall be performed in such a manner that protects the adjacent property.

SECTION 1506—TEMPORARY USE OF STREETS, ALLEYS AND PUBLIC PROPERTY

[BG] 1506.1 Storage and handling of materials. The temporary use of streets or public property for the storage or handling of materials or equipment required for construction or demolition, and the protection provided to the public shall comply with the provisions of the applicable governing authority and this chapter.

[BG] 1506.2 Obstructions. Construction materials and equipment shall not be placed or stored so as to obstruct access to fire hydrants, standpipes, fire or police alarm boxes, catch basins or manholes, nor shall such material or equipment be located within 20 feet (6096 mm) of a street intersection, or placed so as to obstruct normal observations of traffic signals or to hinder the use of public transit loading platforms.

[BG] 1506.3 Utility fixtures. Building materials, fences, sheds or any obstruction of any kind shall not be placed so as to obstruct free approach to any fire hydrant, fire department connection, utility pole, manhole, fire alarm box or catch basin, or so as to interfere with the passage of water in the gutter. Protection against damage shall be provided to such utility fixtures during the progress of the work, but sight of them shall not be obstructed.

SECTION 1507—FIRE EXTINGUISHERS

[F] 1507.1 Where required. Structures under construction, *alteration* or demolition shall be provided with not fewer than one *approved* portable fire extinguisher in accordance with Section 906 of the *Fire Code of New York State* and sized for not less than ordinary hazard as follows:

1. At each stairway on all floor levels where combustible materials have accumulated.
2. In every storage and construction shed.
3. Additional portable fire extinguishers shall be provided where special hazards exist, such as the storage and use of flammable and combustible liquids.

[F] 1507.2 Fire hazards. The provisions of this code and of the *Fire Code of New York State* shall be strictly observed to safeguard against all fire hazards attendant upon construction operations.

SECTION 1508—MEANS OF EGRESS

[BE] 1508.1 Stairways required. Where building construction exceeds 40 feet (12 192 mm) in height above the lowest level of fire department vehicle access, a temporary or permanent stairway shall be provided. As construction progresses, such stairway shall be extended to within one floor of the highest point of construction having secured decking or flooring.

[F] 1508.2 Maintenance of means of egress. Means of egress and required accessible means of egress shall be maintained at all times during construction, demolition, remodeling or *alterations* and *additions* to any building.

Exception: Existing means of egress need not be maintained where *approved* temporary means of egress and accessible means of egress systems and facilities are provided.

SECTION 1509—STANDPIPES

[F] 1509.1 Where required. In buildings required to have standpipes by Section 905.3.1 of the *Building Code of New York State*, not less than one standpipe shall be provided for use during construction. Such standpipes shall be installed prior to construction exceeding 40 feet (12 192 mm) in height above the lowest level of fire department vehicle access. Such standpipes shall be provided with fire department hose connections at locations adjacent to *stairways*, complying with Section 1508.1. As construction progresses, such standpipes shall be extended to within one floor of the highest point of construction having secured decking or flooring.

[F] 1509.2 Buildings being demolished. Where a building or portion of a building is being demolished and a standpipe is existing within such a building, such standpipe shall be maintained in an operable condition so as to be available for use by the fire department. Such standpipe shall be demolished with the building but shall not be demolished more than one floor below the floor being demolished.

[F] 1509.3 Detailed requirements. Standpipes shall be installed in accordance with the provisions of Chapter 9 of the *Building Code of New York State*.

Exception: Standpipes shall be either temporary or permanent in nature, and with or without a water supply, provided that such standpipes conform to the requirements of Section 905 of the *Building Code of New York State* as to capacity, outlets and materials.

SECTION 1510—AUTOMATIC SPRINKLER SYSTEM

[NY] 1510.1 Completion before occupancy. In buildings where an automatic sprinkler system is required by this code or the *Building Code of New York State*, it shall be unlawful to occupy any portions of a building or structure until the automatic sprinkler system installation has been tested and *approved*.

[F] 1510.2 Operation of valves. Operation of sprinkler control valves shall be permitted only by properly authorized personnel and shall be accompanied by notification of duly designated parties. When the sprinkler protection is being regularly turned off and on to facilitate connection of newly completed segments, the sprinkler control valves shall be checked at the end of each work period to ascertain that protection is in service.

SECTION 1511—ACCESSIBILITY

[BE] 1511.1 Construction sites. Structures, sites and equipment directly associated with the actual process of construction, including, but not limited to, scaffolding, bridging, material hoists, material storage or construction trailers, are not required to be accessible.

SECTION 1512—WATER SUPPLY FOR FIRE PROTECTION

[F] 1512.1 When required. An *approved* water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible building material arrives on the site, on commencement of vertical combustible construction, and on installation of a standpipe system in buildings under construction, in accordance with Sections 1512.1 through 1512.5.

Exception: The fire code official is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

[F] 1512.2 Combustible building materials. When combustible building materials of the building under construction are delivered to a site, a minimum fire flow of 500 gallons per minute (1893 L/m) shall be provided. The fire hydrant used to provide this fire flow supply shall be within 500 feet (152 m) of the combustible building materials as measured along an *approved* fire apparatus access lane. Where the site configuration is such that one fire hydrant cannot be located within 500 feet (152 m) of all combustible building materials, additional fire hydrants shall be required to provide coverage in accordance with this section.

[F] 1512.3 Vertical construction of Types III, IV and V construction. Prior to commencement of vertical construction of Type III, IV or V buildings that utilize any combustible building materials, the fire flow required by Sections 1512.3.1 through 1512.3.3 shall be provided, accompanied by fire hydrants in sufficient quantity to deliver the required fire flow and proper coverage.

[F] 1512.3.1 Fire separation up to 30 feet. Where a building of Type III, IV or V construction has a fire separation distance of less than 30 feet (9144 mm) from property lot lines, and an adjacent property has an *existing structure* or otherwise can be built on, the water supply shall provide either a minimum of 500 gallons per minute (1893 L/m), or the entire fire flow required for the building when constructed, whichever is greater.

[F] 1512.3.2 Fire separation of 30 feet up to 60 feet. Where a building of Type III, IV or V construction has a fire separation distance of 30 feet (9144 mm) up to 60 feet (18 288 mm) from property lot lines, and an adjacent property has an *existing structure* or otherwise can be constructed upon, the water supply shall provide a minimum of 500 gallons per minute (1893 L/m), or 50 percent of the fire flow required for the building when constructed, whichever is greater.

[F] 1512.3.3 Fire separation of 60 feet or greater. Where a building of Type III, IV or V construction has a fire separation of 60 feet (18 288 mm) or greater from a property lot line, a water supply of 500 gallons per minute (1893 L/m) shall be provided.

[F] 1512.4 Vertical construction, Types I and II construction. If combustible construction materials are delivered to the construction site, water supply in accordance with Section 1509.2 shall be provided. Additional water supply for fire flow is not required prior to commencing vertical construction of Type I and II buildings.

[F] 1512.5 Standpipe supply. Regardless of the presence of combustible building materials, the construction type or the fire separation distance, where a standpipe is required in accordance with Section 1509, a water supply providing a minimum flow of 500 gallons per minute (1893 L/m) shall be provided. The fire hydrant used for this water supply shall be located within 100 feet (30 480 mm) of the fire department connection supplying the standpipe.

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CHAPTER

16 REFERENCED STANDARDS

User notes:

About this chapter: *This code contains numerous references to standards that are used to regulate materials and methods of construction. Chapter 16 contains a comprehensive list of all standards that are referenced in the code, including the appendices. The standards are part of the code to the extent of the reference to the standard. Compliance with the referenced standard is necessary for compliance with this code. By providing specifically adopted standards, the construction and installation requirements necessary for compliance with the code can be readily determined. The basis for code compliance is, therefore, established and available on an equal basis to the building code official, contractor, designer and owner.*

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section 102.4.

An asterisk (*) denotes standards that are incorporated by reference into 19 NYCRR Part 1227.

ACI *American Concrete Institute, 38800 Country Club Drive, Farmington Hills, MI 48331-3439*

***562—21: Assessment, Repair, and Rehabilitation of Existing Concrete Structures—Code Requirements**
405.1.1

AISC *American Institute of Steel, 130 East Randolph Street, Suite 2000, Chicago, IL 60601-6219*

*** ANSI/AISC 341—22: Seismic Provisions for Structural Steel Buildings**
A403.10.1, A403.10.2

ASCE/SEI *American Society of Civil Engineers Structural Engineering Institute, 1801 Alexander Bell Drive, Reston, VA 20191-4400*

7—1988: Minimum Design Loads and Associated Criteria for Buildings and Other Structures
503.12, 706.3.2

7—1993: Minimum Design Loads and Associated Criteria for Buildings and Other Structures
503.12, 706.3.2

7—1995: Minimum Design Loads and Associated Criteria for Buildings and Other Structures
503.12, 706.3.2

7—1998: Minimum Design Loads and Associated Criteria for Buildings and Other Structures
503.12, 706.3.2

7—2002: Minimum Design Loads and Associated Criteria for Buildings and Other Structures
503.12, 706.3.2

7—2005: Minimum Design Loads and Associated Criteria for Buildings and Other Structures
503.12, 706.3.2

7—2010: Minimum Design Loads and Associated Criteria for Buildings and Other Structures
503.12, 706.3.2

7—2016 with Supplement 1: Minimum Design Loads and Associated Criteria for Buildings and Other Structures
503.12, 706.3.2

7—2022: Minimum Design Loads and Associated Criteria for Buildings and Other Structures
304.2, 304.3.1, 503.4, 503.12, 503.13, 706.3.2, 805.3, 805.4, A104.1, A205.1, A206.1, A206.2, A206.3, A206.4, A206.7, A403.3

41—2023: Seismic Evaluation and Retrofit of Existing Buildings
304.3.1, Table 304.3.1, 304.3.2, Table 304.3.2, 503.5, 503.11, 506.5.3, 906.2, 906.3, 1006.3

ASHRAE *ASHRAE, 180 Technology Parkway, Peachtree Corners, GA 30092*

***62.1—2022: Ventilation for Acceptable Indoor Air Quality**
807.2

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ASME *American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016*

***A17.1—2022/CSA B44—2022: Safety Code for Elevators and Escalators**
306.7.7, 306.7.8, 902.1.2

***A17.3—2023: Safety Code for Existing Elevators and Escalators**
902.1.2

***A18.1—2023: Safety Standard for Platform Lifts and Stairway Chair Lifts**
306.7.9

ASTM *ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959*

A36/A36M—19: Specification for Carbon Structural Steel
A405.3.3

A653/A653M—20: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
A304.2.6

B695—2021: Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
A304.2.6

C67/C67M—21: Test Methods of Sampling and Testing Brick and Structural Clay Tile
A106.2.3.1

C94/C94M—21b: Standard Specification for Ready-Mixed Concrete
109.3.1

C140/C140M—22a: Test Method Sampling and Testing Concrete Masonry Units and Related Units
A106.2.3.1

C496—96/C496M—11: Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
A104.1, A106.2.3.3

C1531—15: Standard Test Methods for In Situ Measurement of Masonry Mortar Joint Shear Strength Index
A106.2.3.2

E108—20a: Standard Test Methods for Fire Tests of Roof Coverings
1204.5

E136—22: Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C
202

E488/E488M—15: Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
A107.5.1, A107.5.3

E519/E519M—2010: Standard Test Method for Diagonal Tension (Shear) in Masonry Assemblages
A104.1

F2006—21: Standard Safety Specification for Window Fall Prevention Devices for Non-Emergency Escape (Egress) and Rescue (Ingress) Windows
505.2, 702.4

F2090—21: Specification for Window Fall Prevention Devices with Emergency (Egress) Release Mechanisms
505.2, 505.3.1, 702.4, 702.5.1

F2285—22: Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use
F105.3

ICC *International Code Council, Inc., 200 Massachusetts Avenue, NW, Suite 250, Washington, DC 20001*

***BCNYS—24:** *Building Code of New York State*
101.4.1, 104.3.1, 106.2.2, 109.3.3, 109.3.6, 109.3.9, 109.3.10, 110.2, 202, 301.3, 302.4.1, 302.5, 303.1, 303.3, 304.1, 304.3.1, 304.3.2, 305.1, 306.5, 306.6.1, 306.6.1.1, 306.7, 306.7.2, 306.7.4, 306.7.5, 306.7.7, 306.7.10, 306.7.11, 306.7.11.1, 306.7.11.2, 306.7.11.3, 306.7.12, 306.7.13, 306.7.15, 306.7.17, 306.7.18, 306.7.18.3, 306.7.18.4, 306.7.18.5, 306.7.18.7, 309.2, 309.2.1, 401.3, 402.1, 405.2.1.1, 405.2.3.1, 405.2.3.3, 405.2.4, 405.2.5, 405.2.6, 501.2, 502.1, 502.1.1, 502.1.2, 502.2, 502.3, 502.4, 502.5, 503.1, 503.2, 503.3, 503.4, 503.5, 503.11, 503.12, 503.13, 503.14, 503.15, 503.16, 503.17, 503.19, 503.20, 505.3, 505.4, 506.1, 506.3, 506.4, 506.5.1, 506.5.2, 506.5.3, 506.5.4, 507.3, 701.2, 701.3, 702.1, 702.2, 702.3, 702.5, 702.6, 702.7, 704.1.1, 704.3, 705.1, 705.2, 706.2, 706.3.2, 802.2.1, 802.2.3, 802.3, 802.4, 802.5.2, 802.6, 802.6, 803.1.1, 803.2, 803.2.2, 803.2.3, 803.2.4, 803.2.5, 803.2.6, 803.3, 804.1, 804.4, 804.5.1, 804.5.1.1, Table 804.5.1.1(1), 804.5.1.2.1, 804.6.1.2, 804.6.3, 804.6.4, 804.6.5, 804.7, 804.7.3, 804.8, 804.9.1, 804.10, 804.10.1, 804.10.1, 804.11, 804.13.2, 804.14.2, 805.2, 805.3, 805.4, 904.1.2, 904.1.3, 904.1.4, 904.1.6, 904.1.7, 904.1.8, 904.2, 904.2.1, 904.2.2, 905.2, 905.3, 905.4, 906.2, 906.3, 906.6, 1001.2, 1001.3, 1002.1, 1002.2, 1002.3, 1002.4, 1004.1, 1006.1, 1006.2, 1006.3, 1006.4, 1010.1, 1011.1, 1011.2.1, 1011.2.2, 1011.3, 1011.5.1, 1011.5.2, 1011.5.3, 1011.5.6, 1011.6.1, 1011.6.1.1, 1011.6.3, 1011.7.1, 1011.7.2, 1011.7.3,

1011.8.1, 1011.8.2, 1011.8.3, 1101.2, 1101.3, 1101.5, 1101.7, 1102.1, 1102.2, 1102.3, 1103.1, 1103.2, 1103.3, 1201.4, 1202.2, 1203.12, 1204.2, 1204.9, 1206.1, 1302.1.2, 1302.1.3, 1302.1.4, 1303.1.3, 1304.1.1, 1305.2.1, 1305.2.1.1, 1305.2.2, 1305.2.2.1, 1305.2.3.2, 1305.2.3.3, 1305.2.4.1, 1305.2.5, 1305.2.5.1, 1305.2.6, 1305.2.7.1, 1305.2.8, 1305.2.9, 1305.2.9.1, 1305.2.10, 1305.2.10.1, 1305.2.11, 1305.2.11.1, 1305.2.12.1, 1305.2.13, Table 1305.2.15, 1305.2.15.1, 1305.2.16.1, 1305.2.17, 1305.2.17.1, 1305.2.18, 1305.2.18.1, 1305.2.19, Table 1305.2.19, 1305.2.20, 1305.2.20.1, 1307.1.1, 1401.2, 1402.1, 1402.2, 1402.2.1, 1402.3, 1402.4, 1402.5, 1402.6, 1501.5, 1504.1.1, 1504.1.4.1, 1504.1.7, 1509.1, 1509.3, 1510.1, E106.3, E106.5.1, F102.1

IBC—00: International Building Code®

A202.1

IBC—03: International Building Code®

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IBC—06: International Building Code®

A202.1

IBC—09: International Building Code®

A202.1

IBC—12: International Building Code®

A202.1

IBC—15: International Building Code®

A202.1

IBC—18: International Building Code®

A202.1

IBC—21: International Building Code®

A202.1

***ICC 300—2023: ICC Standard on Bleachers, Folding and Telescopic Seating and Grandstands**

301.1.1, 401.1.1, 1401.1.1

***ICC A117.1—2017: Accessible and Usable Buildings and Facilities**

306.3, 306.7, 306.7.11, 306.7.12, 306.7.13, 502.6, 503.18, 1011.4, 1101.6, F105.1, F106.1

***ICC/NSSA 500—2020: ICC/NSSA Standard for the Design and Construction of Storm Shelters**

303.1.1, 303.2

ICCPC-24: ICC Performance Code®

104.2.3

***ECCCNYS—25: Energy Conservation Construction Code of New York State**

302.2, 702.7, 708.1, 809.1, 907.1, 1104.1

***FCNYS—25: Fire Code of New York State**

101.2.2, 101.4.2, 301.3.1, 302.2, 307.1, 308.1, 802.2.1, 802.2.3, 803.2.3, 803.4.1.1, 803.4.1.2, 803.4.1.3, 803.4.1.4, 803.4.1.5, 803.4.1.6, Table 804.5.1.1(1), 904.1.5, 1011.6.1.1, 1303.1.2, 1305.2.8.1, 1305.2.14, 1305.2.14.1, 1401.2, 1501.1, 1501.5, 1502.1, 1502.1.1, 1502.2, 1502.3, 1504.1, 1507.1, 1507.2

***FGCNYS—25: Fuel Gas Code of New York State**

302.2, 702.7.1, E106.4, E106.4.1, E106.4.2, E106.4.5, E106.7.1, E107.1.3, E107.2.2, E107.3.3, E107.3.4

***MCNYS—25: Mechanical Code of New York State**

302.2, 702.7, 807.1, 902.1.1, 1008.1, 1305.2.7.1, 1305.2.8, 1305.2.8.1

***PCNYS—25: Plumbing Code of New York State**

302.2, 408.1, 702.7, 1009.1, 1009.2, 1009.3, 1009.5, 1302.1.6, 1503.1

***PMCNYS—25: Property Maintenance Code of New York State**

101.4.2, 302.2, 1303.1.2, 1401.2

***RCNYS—25: Residential Code of New York State**

101.2, 101.4.1, 104.3.1, 109.3.3, 109.3.10, 302.2, 307.1, 308.1, 401.3, 402.1, 405.2.6, 502.2, 502.3, 502.4, 503.2, 503.3, 503.11, 505.2, 505.3, 507.3, 701.3, 702.4, 702.5, 706.2, 708.1, 805.2, 806.4, 809.1, 906.2, 907.1, 1011.2.1, 1103.1, 1103.2, 1103.3, 1104.1, 1201.4, 1302.1.2, 1302.1.3, 1302.1.3, 1303.1.3, 1401.2, 1402.1, 1402.2, 1402.2.1, 1402.3, 1402.4, 1402.5, 1402.6

UBC—97: Uniform Building Code

A202.1

NFPA *National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471*

***NFPA 70—23: National Electrical Code**

302.2, 406.1, 406.1.1, 406.1.2, 806.1, 806.4.4, 806.4.7, 1007.1, 1007.2, 1007.3, 1007.4

***NFPA 72—22: National Fire Alarm and Signaling Code**
803.4.3

***NFPA 99—24: Health Care Facilities Code**
302.2.1, 406.1.1, 406.1.2, 408.3, 501.3, 707.1, 806.3, 808.1, 1007.1

***NFPA 101—24: Life Safety Code**
804.2

NFPA 550—17: Guide to the Fire Safety Concepts Tree
E106.4.3

TMS *The Masonry Society, 105 South Sunset Street, Suite Q, Longmont, CO 80501-6172*

***402—2022: Building Code Requirements for Masonry Structures**
A105.4, Table A108.1(2)

UL *UL LLC, 333 Pfingsten Road, Northbrook, IL 60062*

790—04: Standard Test Methods for Fire Tests of Roof Coverings—with Revisions through October 2018
1204.5

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APPENDIX

A GUIDELINES FOR THE SEISMIC RETROFIT OF EXISTING BUILDINGS

User notes:

About this appendix: *Appendix A provides guidelines for upgrading the seismic-resistance capacity of different types of existing buildings. It is organized into separate chapters that deal with buildings of different types, including unreinforced masonry buildings, reinforced concrete and reinforced masonry wall buildings, and light-frame wood buildings.*

CHAPTER A1
SEISMIC STRENGTHENING PROVISIONS FOR UNREINFORCED MASONRY BEARING WALL BUILDINGS

SECTION A101—PURPOSE

[BS] A101.1 Purpose. The purpose of this chapter is to promote public safety and welfare by reducing the risk of death or injury from the effects of earthquakes on existing unreinforced masonry bearing wall buildings.

The provisions of this chapter are intended as minimum standards for structural seismic resistance, and are established primarily to reduce the risk of life loss or injury. Compliance with these provisions will not necessarily prevent loss of life or injury, or prevent earthquake damage to retrofitted buildings.

SECTION A102—SCOPE

[BS] A102.1 General. The provisions of this chapter shall apply to all *existing buildings* not more than six stories in height above the base of the structure and having not fewer than one unreinforced masonry bearing wall. The elements regulated by this chapter shall be determined in accordance with Table A102.1. Except as provided herein, other structural provisions of the building code shall apply. This chapter does not apply to the *alteration* of existing electrical, plumbing, mechanical or fire safety systems.

[BS] TABLE A102.1—ELEMENTS REGULATED BY THIS CHAPTER

BUILDING ELEMENTS	S_{D1}			
	≥ 0.067g < 0.133g	≥ 0.133g < 0.20g	≥ 0.20g < 0.30g	≥ 0.30g
Parapets	X	X	X	X
Walls, anchorage	X	X	X	X
Walls, *h/t* ratios		X	X	X
Walls, in-plane shear		X	X	X
Diaphragms[a]			X	X
Diaphragms, shear transfer[b]		X	X	X
Diaphragms, demand-capacity ratios[b]			X	X

a. Applies only to buildings designed according to the general procedures of Section A110.
b. Applies only to buildings designed according to the special procedures of Section A111.

[BS] A102.2 Essential and hazardous facilities. The provisions of this chapter shall not apply to the strengthening of buildings in *Risk Category* III or IV. Such buildings shall be strengthened to meet the requirements of the *Building Code of New York State* for new buildings of the same *risk category* or other such criteria *approved* by the *code official*.

SECTION A103—DEFINITIONS

[BS] A103.1 Definitions. For the purpose of this chapter, the applicable definitions in the building code shall also apply.

[BS] BED JOINT. The horizontal layer of mortar on which a masonry unit is laid.

[BS] COLLAR JOINT. The vertical space between adjacent wythes. A collar joint may contain mortar or grout.

[BS] CROSSWALL. A new or existing wall that meets the requirements of Section A111.3. A crosswall is not a shear wall.

[BS] CROSSWALL SHEAR CAPACITY. The unit shear value times the length of the crosswall, $v_c L_c$.

[BS] DETAILED BUILDING SYSTEM ELEMENTS. The localized elements and the interconnections of these elements that define the design of the building.

[BS] DIAPHRAGM EDGE. The intersection of the horizontal diaphragm and a shear wall.

[BS] DIAPHRAGM SHEAR CAPACITY. The unit shear value times the depth of the diaphragm, $v_u D$.

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[BS] FLEXIBLE DIAPHRAGM. A diaphragm of wood or untopped metal deck construction in which the horizontal deformation along its length is at least two times the average story drift.

HEAD JOINT. The vertical mortar joint placed between masonry units within the wythe.

[BS] NORMAL WALL. A wall perpendicular to the direction of seismic forces.

[BS] OPEN FRONT. An exterior building wall line on one side only without vertical elements of the seismic force-resisting system in one or more stories.

[BS] POINTING. The process of removal of deteriorated mortar from between masonry units and placement of new mortar. Also known as repointing or tuckpointing for purposes of this chapter.

[BS] REPOINTING. See "*Pointing*."

[BS] RIGID DIAPHRAGM. A diaphragm of concrete construction or concrete-filled metal deck construction.

[BS] TUCKPOINTING. See "*Pointing*."

[BS] UNREINFORCED MASONRY (URM). Includes burned clay, concrete or sand-lime brick; hollow clay or concrete block; plain concrete; and hollow clay tile. These materials shall comply with the requirements of Section A106 as applicable.

[BS] UNREINFORCED MASONRY BEARING WALL. A URM wall that provides the vertical support for the reaction of floor or roof-framing members for which the total superimposed vertical load exceeds 100 pounds per linear foot (1459 N/m) of wall length.

[BS] UNREINFORCED MASONRY WALL. A masonry wall that relies on the tensile strength of masonry units, mortar and grout in resisting design loads, and in which the area of reinforcement is less than the minimum amounts as defined for reinforced masonry walls.

[BS] YIELD STORY DRIFT. The lateral displacement of one level relative to the level above or below at which yield stress is first developed in a frame member.

SECTION A104—SYMBOLS AND NOTATIONS

[BS] A104.1 Symbols and notations. For the purpose of this chapter, the following notations supplement the applicable symbols and notations in the building code.

a_n = Diameter of core multiplied by its length or the area of the side of a square prism.

A = Cross-sectional area of unreinforced masonry pier or wall, square inches (10^{-6} m^2).

A_b = Total area of the bed joints above and below the test specimen for each in-place shear test, square inches (10^{-6} m^2).

A_n = Area of net mortared or grouted section of a wall or wall pier.

D = In-plane width dimension of pier, inches (10^{-3} m), or depth of diaphragm, feet (m).

DCR = Demand-capacity ratio specified in Section A111.4.2.

f'_m = Lower bound masonry compressive strength.

f_{sp} = Splitting-tensile strength of masonry.

F_{wx} = Force applied to a wall at level x, pounds (N).

H = Least clear height of opening on either side of a pier, inches (10^{-3} m).

h/t = Height-to-thickness ratio of URM wall. Height, h, is measured between wall anchorage levels and/or slab-on-grade.

L = Span of diaphragm between shear walls, or span between shear wall and open front, feet (m).

L_c = Length of crosswall, feet (m).

L_i = Effective diaphragm span for an open-front building specified in Section A111.8, feet (m).

P = Applied force as determined by standard test method of ASTM C496 or ASTM E519, pounds (N).

P_D = Superimposed dead load at the location under consideration, pounds (N). For determination of the rocking shear capacity, dead load at the top of the pier under consideration shall be used.

P_{D+L} = Stress resulting from the dead plus actual live load in place at the time of testing, pounds per square inch (kPa).

P_{test} = Splitting tensile test load determined by standard test method ASTM C496, pounds (N).

P_w = Weight of wall, pounds (N).

R = Response modification factor for Ordinary plain masonry shear walls in Bearing Wall System from Table 12.2-1 of ASCE 7, where R = 1.5.

S_{DS} = Design spectral acceleration at short period, in g units.

S_{D1} = Design spectral acceleration at 1-second period, in g units.

v_a = The shear strength of any URM pier, v_mA/1.5 pounds (N).

v_c = Unit shear strength for a crosswall sheathed with any of the materials given in Table A108.1(1) or Table A108.1(2), pounds per foot (N/m).

v_{mL} = Shear strength of unreinforced masonry, pounds per square inch (kPa).

V_{aa} = The shear strength of any URM pier or wall, pounds (N).

V_{ca} = Total shear capacity of crosswalls in the direction of analysis immediately above the diaphragm level being investigated, v_cL_c, pounds (N).

V_{cb} = Total shear capacity of crosswalls in the direction of analysis immediately below the diaphragm level being investigated, v_cL_c, pounds (N).

V_p = Shear force assigned to a pier on the basis of its relative shear rigidity, pounds (N).

V_r = Pier rocking shear capacity of any URM wall or wall pier, pounds (N).

v_{test} = Load at incipient cracking for each in-place shear test performed in accordance with Section A106.2.3.6, pounds (N).

v_{tl} = Lower bound mortar shear strength, pounds per square inch (kPa).

v_{to} = Mortar shear test values as specified in Section A106.2.3.6, pounds per square inch (kPa).

v_u = Unit shear capacity value for a diaphragm sheathed with any of the materials given in Table A108.1(1) or A108.1(2), pounds per foot (N/m).

V_{wx} = Total shear force resisted by a shear wall at the level under consideration, pounds (N).

W = Total seismic dead load as defined in the building code, pounds (N).

W_d= Total dead load tributary to a diaphragm level, pounds (N).

W_w = Total dead load of a URM wall above the level under consideration or above an open-front building, pounds (N).

W_{wx} = Dead load of a URM wall assigned to level x halfway above and below the level under consideration, pounds (N).

Σv_uD = Sum of diaphragm shear capacities of both ends of the diaphragm, pounds (N).

$\Sigma\Sigma v_uD$ = For diaphragms coupled with crosswalls, v_uD includes the sum of shear capacities of both ends of diaphragms coupled at and above the level under consideration, pounds (N).

ΣW_d = Total dead load of all the diaphragms at and above the level under consideration, pounds (N).

SECTION A105—GENERAL REQUIREMENTS

[BS] A105.1 General. The seismic force-resisting system specified in this chapter shall comply with the *Building Code of New York State* and referenced standards, except as modified herein.

[BS] A105.2 Alterations and repairs. *Alterations* and *repairs* required to meet the provisions of this chapter shall comply with applicable structural requirements of the building code unless specifically provided for in this chapter.

[BS] A105.3 Requirements for plans. The following construction information shall be included in the plans required by this chapter:

1. Dimensioned floor and roof plans showing existing walls and the size and spacing of floor and roof-framing members and sheathing materials. The plans shall indicate all existing URM walls, and new crosswalls and shear walls, and their materials of construction. The location of these walls and their openings shall be fully dimensioned and drawn to scale on the plans.
2. Dimensioned URM wall elevations showing openings, piers, wall classes as defined in Section A106.2.3.9, thickness, heights, wall shear test locations, cracks or damaged portions requiring *repairs*, the general condition of the mortar joints, and if and where pointing is required. Where the exterior face is veneer, the type of veneer, its thickness and its bonding and/or ties to the structural wall masonry shall be noted.
3. The type of interior wall and ceiling materials, and framing.
4. The extent and type of existing wall anchorage to floors and roof where used in the design.
5. The extent and type of parapet corrections that were previously performed, if any.
6. *Repair* details, if any, of cracked or damaged unreinforced masonry walls required to resist forces specified in this chapter.
7. All other plans, sections and details necessary to delineate required retrofit construction.
8. The design procedure used shall be stated on both the plans and the permit application.
9. Details of the anchor prequalification program required by Section A107.5.3, if used, including location and results of all tests.
10. Quality assurance requirements of special inspection for all new construction materials and for retrofit construction including: anchor tests, pointing or repointing of mortar joints, installation of adhesive or mechanical anchors, and other elements as deemed necessary to ensure compliance with this chapter.

[BS] A105.4 Structural observation, testing and inspection. Structural observation, in accordance with Section 1704.6 of the *Building Code of New York State*, shall be required for all structures in which seismic retrofit is being performed in accordance with this chapter. Structural observation shall include visual observation of work for compliance with the *approved* construction documents and confirmation of existing conditions assumed during design.

Structural testing and inspection for new and existing construction materials shall be in accordance with the building code, except as modified by this chapter.

Special inspection as described in Section A105.3, Item 10, shall be provided equivalent to Level 3 as prescribed in TMS 402, Table 3.1(2).

SECTION A106—MATERIALS REQUIREMENTS

[BS] A106.1 Condition of existing materials. Existing materials used as part of the required vertical load-carrying or seismic force-resisting system shall be evaluated by on-site investigation and: determined to be in good condition (free of degraded mortar, degraded masonry units or significant cracking); or shall be repaired, enhanced, retrofitted or removed and replaced with new materials. Mortar joint deterioration shall be patched by pointing or repointing of the eroded joint in accordance with Section A106.2.3.10. Existing significant cracks in solid unit unreinforced and solid grouted hollow unit masonry shall be repaired.

[BS] A106.2 Existing unreinforced masonry.

[BS] A106.2.1 General. Unreinforced masonry walls used to support vertical loads or seismic forces parallel and perpendicular to the wall plane shall be tested as specified in this section. Masonry that does not meet the minimum requirements established by this chapter shall be repaired, enhanced, removed and replaced with new materials, or alternatively, shall have its structural functions replaced with new materials and shall be anchored to supporting elements.

[BS] A106.2.2 Lay-up of walls. Unreinforced masonry walls shall be laid in a running bond pattern.

[BS] A106.2.2.1 Header in multiple-wythe solid brick. The facing and backing wythes of multiple-wythe walls shall be bonded so that not less than 10 percent of the exposed face area is composed of solid headers extending not less than 4 inches (102 mm) into the backing wythes. The clear distance between adjacent header courses shall not exceed 24 inches (610 mm) vertically or horizontally. Where backing consists of two or more wythes, the headers shall extend not less than 4 inches (102 mm) into the most distant wythe, or the backing wythes shall be bonded together with separate headers for which the area and spacing conform to the foregoing. Wythes of walls not meeting these requirements shall be considered to be veneer, and shall not be included in the effective thickness used in calculating the height-to-thickness ratio and the shear capacity strength of the wall.

Exception: Where S_{D1} is 0.3 g or less, veneer wythes anchored and made composite with backup masonry are permitted to be used for calculation of the effective thickness.

[BS] A106.2.2.2 Lay-up patterns. Lay-up patterns other than those specified in Section A106.2.2.1 are allowed if their performance can be justified.

[BS] A106.2.3 Testing of masonry.

[BS] A106.2.3.1 Concrete masonry units and structural clay load-bearing tile. Grouted or ungrouted hollow concrete masonry units shall be tested in accordance with ASTM C140. Grouted or ungrouted structural clay load-bearing tile shall be tested in accordance with ASTM C67.

[BS] A106.2.3.2 In-place mortar joint shear tests. Mortar joint shear test values, v_{to}, shall be obtained by one of the following:

1. ASTM C1531.
2. For masonry walls that have high shear strength mortar, or where in-place testing is not practical because of crushing or other failure mode of the masonry, alternative procedures for testing shall be used in accordance with Section A106.2.3.2.

[BS] A106.2.3.3 Alternative procedures for testing masonry. The splitting tensile strength of existing masonry, f_{sp}, or the prism strength of existing masonry, f'_m, is permitted to be determined in accordance with ASTM C496 and calculated by the following equation:

Equation A1-1 $$f_{sp} = \frac{0.494P}{a_n}$$

[BS] A106.2.3.4 Location of tests. The shear tests shall be taken at locations representative of the mortar conditions throughout the building. Test locations shall be determined at the building site by the *registered design professional* in charge. Results of all tests and their locations shall be recorded.

[BS] A106.2.3.5 Number of tests. The minimum number of tests per masonry class shall be determined as follows:

1. At each of both the first and top stories, not less than two tests per wall or line of wall elements providing a common line of resistance to seismic forces.
2. At each of all other stories, not less than one test per wall or line of wall elements providing a common line of resistance to seismic forces.
3. In any case, not less than one test per 1,500 square feet (139.4 m^2) of wall surface and not less than a total of eight tests.

[BS] A106.2.3.6 Minimum quality of mortar.

1. Mortar shear test values, v_{to}, in pounds per square inch (kPa), shall be obtained for each in-place shear test in accordance with the following equation:

   Equation A1-2 $v_{to} = (V_{test}/A_b) - P_{D+L}$

   where:

   V_{test} = Load at first observed movement.

   A_b = Total area of the bed joints above and below the test specimen.

P_{D+L} = Stress resulting from actual dead plus live loads in place at the time of testing.

2. Individual unreinforced masonry walls with more than 50 percent of mortar test values, v_{to}, less than 30 pounds per square inch (207 kPa) shall be pointed prior to and retested.
3. The lower bound mortar shear strength, v_{tL}, is defined as the mean minus one standard deviation of the mortar shear test values, v_{to}.
4. Unreinforced masonry with mortar shear strength, v_{tL}, less than 30 pounds per square inch (207 kPa) shall be pointed and retested or shall have its structural function replaced, and shall be anchored to supporting elements in accordance with Sections A106.2.1 and A113.8. When existing mortar in any wythe is pointed to increase its shear strength and is retested, the condition of the mortar in the adjacent bed joints of the inner wythe or wythes and the opposite outer wythe shall be examined for extent of deterioration. The shear strength of any wall class shall be not greater than that of the weakest wythe of that class.

[BS] A106.2.3.7 Minimum quality of masonry. Where the alternative procedures of Section A106.2.3.2 are used to determine masonry quality, the following minimums apply:

1. The minimum average value of splitting tensile strength, f_{sp}, as calculated by Equation A1-1 shall be 50 pounds per square inch (344.7 kPa).
2. Individual unreinforced masonry walls with average splitting tensile strength of less than 50 pounds per square inch (344.7 kPa) shall be pointed and retested.
3. The lower-bound mortar strength f_{spL} is defined as the mean minus one standard deviation P_{D+L} of the splitting tensile test values f_{sp}.

[BS] A106.2.3.8 Collar joints. The collar joints shall be inspected at the test locations during each in-place shear test, and estimates of the percentage of surfaces of the adjacent wythe that are covered with mortar shall be reported along with the results of the in-place shear tests.

[BS] A106.2.3.9 Unreinforced masonry classes. Existing unreinforced masonry shall be categorized into one or more classes based on shear strength, quality of construction, state of *repair*, deterioration and weathering. A class shall be characterized by the masonry shear strength determined in accordance with Section A108.2. Classes are defined for whole walls, not for small areas of masonry within a wall. Discretion in the definition of classes of masonry is permitted to avoid unnecessary testing.

[BS] A106.2.3.10 Pointing. Deteriorated mortar joints in unreinforced masonry walls shall be pointed in accordance with the following requirements:

1. **Joint preparation**. Deteriorated mortar shall be cut out by means of a toothing chisel or nonimpact power tool until sound mortar is reached, to a depth not less than $^3/_4$ inch (19.1 mm) or twice the thickness of the joint, whichever is less, but not greater than 2 inches (50 mm). Care shall be taken not to damage the masonry edges. After cutting is complete, all loose material shall be removed with a brush, or air or water stream.
2. **Mortar preparation.** The mortar mix shall be proportioned as required by the construction specifications and manufacturer's *approved* instructions.
3. **Packing.** The joint into which the mortar is to be packed shall be dampened but without free-standing water. The mortar shall be tightly packed into the joint in layers not exceeding $^1/_4$ inch (6.4 mm) deep until it is filled; then it shall be tooled to a smooth surface to match the original profile.

Nothing shall prevent pointing of any masonry wall joints before testing is performed in accordance with Section A106.2.3, except as required in Section A107.2.

SECTION A107—QUALITY CONTROL

[BS] A107.1 Pointing. Preparation and mortar pointing shall be performed with special inspection.

Exception: At the discretion of the *code official*, incidental pointing may be performed without special inspection.

[BS] A107.2 Masonry shear tests. In-place masonry shear tests shall comply with Section A106.2.3.1. Testing of masonry for determination of splitting tensile strength shall comply with Section A106.2.3.3.

[BS] A107.3 Existing wall anchors. Existing wall anchors used as all or part of the required tension anchors shall be tested in pullout according to Section A107.5.1. Not fewer than four anchors tested per floor shall be tested in pullout, with not fewer than two tests at walls with joists framing into the wall and two tests at walls with joists parallel to the wall, but not less than 10 percent of the total number of existing tension anchors at each level.

[BS] A107.4 New wall anchors. New wall anchors embedded in URM walls shall be subject to special inspection prior to placement of the anchor and grout or adhesive in the drilled hole. Five percent of all anchors that do not extend through the wall shall be subject to a direct-tension test, and an additional 20 percent shall be tested using a calibrated torque wrench. Testing shall be performed in accordance with Section A107.5.

New wall anchors embedded in URM walls resisting tension forces or a combination of tension and shear forces shall be subject to special inspection, prior to placement of the anchor and grout or adhesive in the drilled hole. Five percent of all anchors resisting tension forces shall be subject to a direct-tension test, and an additional 20 percent shall be tested using a calibrated torque wrench. Testing shall be performed in accordance with Section A107.5.

Exception: New bolts that extend through the wall with steel plates on the far side of the wall need not be tested.

[BS] A107.5 Tests of anchors in unreinforced masonry walls. Tests of anchors in unreinforced masonry walls shall be in accordance with Sections A107.5.1 through A107.5.3. Results of all tests shall be reported to the authority having jurisdiction. The report shall include the test results of maximum load for each test; pass-fail results; corresponding anchor size and type; orientation of loading; details of the anchor installation, testing apparatus and embedment; wall thickness; and joist orientation and proximity to the tested anchor.

[BS] A107.5.1 Direct tension testing of existing anchors and new anchors. The test apparatus shall be supported by the masonry wall. The test procedure for prequalification of tension and shear anchors shall comply with ASTM E488. Existing wall anchors shall be given a preload of 300 pounds (1335 N) before establishing a datum for recording elongation. The tension test load reported shall be recorded at $^1/_8$ inch (3.2 mm) relative movement between the existing anchor and the adjacent masonry surface. New embedded tension anchors shall be subject to a direct tension load of not less than 2.5 times the design load but not less than 1,500 pounds (6672 N) for 5 minutes.

Exception: Where obstructions occur, the distance between the anchor and the test apparatus support shall be not less than one-half the wall thickness for existing anchors and 75 percent of the embedment length for new embedded anchors.

[BS] A107.5.2 Torque testing of new anchors. Anchors embedded in unreinforced masonry walls shall be tested using a torque-calibrated wrench to the following minimum torques:

$^1/_2$-inch-diameter (12.7 mm) bolts: 40 foot pounds (54.2 N-m).

$^5/_8$-inch-diameter (15.9 mm) bolts: 50 foot pounds (67.8 N-m).

$^3/_4$-inch-diameter (19.1 mm) bolts: 60 foot pounds (81.3 N-m).

[BS] A107.5.3 Prequalification test for bolts and other types of anchors. ASTM E488 or the test procedure in Section A107.5.1 is permitted to be used to determine tension or shear strength values for anchors greater than those permitted by Table A108.1(2). Anchors shall be installed in the same manner and using the same materials as will be used in the actual construction. Not fewer than five tests for each bolt size and type shall be performed for each class of masonry in which they are proposed to be used. The tension and shear strength values for such anchors shall be the lesser of the average ultimate load divided by 5.0 or the average load at which $^1/_8$ inch (3.2 mm) elongation occurs for each size and type of anchor and class of masonry.

SECTION A108—DESIGN STRENGTHS

[BS] A108.1 Strength values.

1. Strength values for existing materials are given in Table A108.1(1) and for new materials in Table A108.1(2).
2. The strength reduction factor, ϕ, shall be taken equal to 1.0.
3. The use of materials not specified herein shall be based on substantiating research data or engineering judgment, as *approved* by the *code official*.

[BS] TABLE A108.1(1)—STRENGTH VALUES FOR EXISTING MATERIALS

EXISTING MATERIALS OR CONFIGURATION OF MATERIALS[a]		STRENGTH VALUES × 14.594 for N/m
Horizontal diaphragms	Roofs with straight sheathing and roofing applied directly to the sheathing.	300 lbs. per ft. for seismic shear
	Roofs with diagonal sheathing and roofing applied directly to the sheathing.	750 lbs. per ft. for seismic shear
	Floors with straight tongue-and-groove sheathing.	300 lbs. per ft. for seismic shear
	Floors with straight sheathing and finished wood flooring with board edges offset or perpendicular.	1,500 lbs. per ft. for seismic shear
	Floors with diagonal sheathing and finished wood flooring.	1,800 lbs. per ft. for seismic shear
	Metal deck welded with minimal welding.[c]	1,800 lbs. per ft. for seismic shear
	Metal deck welded for seismic resistance.[d]	3,000 lbs. per ft. for seismic shear
Crosswalls[b]	Plaster on wood or metal lath.	600 lbs. per ft. for seismic shear
	Plaster on gypsum lath.	550 lbs. per ft. for seismic shear
	Gypsum wallboard, unblocked edges.	200 lbs. per ft. for seismic shear
	Gypsum wallboard, blocked edges.	400 lbs. per ft. for seismic shear
Existing footing, wood framing, structural steel, reinforcing steel	Plain concrete footings.	f'_c = 1,500 psi unless otherwise shown by tests
	Douglas fir wood.	Same as D.F. No. 1
	Reinforcing steel.	F_y = 40,000 psi maximum

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[BS] TABLE A108.1(1)—STRENGTH VALUES FOR EXISTING MATERIALS—continued		
EXISTING MATERIALS OR CONFIGURATION OF MATERIALS[a]		STRENGTH VALUES × 14.594 for N/m
Existing footing, wood framing, structural steel, reinforcing steel—continued	Structural steel.	F_y = 33,000 psi maximum

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm^2, 1 pound = 4.4 N, 1 pound per square inch = 6894.75 N/m^2, 1 pound per foot = 14.43 N/m.

a. Material must be sound and in good condition.
b. Shear values of these materials may be combined, except the total combined value should not exceed 900 pounds per foot.
c. Minimum 22-gage steel deck with welds to supports satisfying the standards of the Steel Deck Institute.
d. Minimum 22-gage steel deck with $^3/_4$-inch diameter plug welds at an average spacing not exceeding 8 inches and with sidelap welds appropriate for the deck span.

[BS] TABLE A108.1(2)—STRENGTH VALUES OF NEW MATERIALS USED IN CONJUNCTION WITH EXISTING CONSTRUCTION		
NEW MATERIALS OR CONFIGURATION OF MATERIALS		STRENGTH VALUES
Horizontal diaphragms	Plywood sheathing applied directly over existing straight sheathing with ends of plywood sheets bearing on joists or rafters and edges of plywood located on center of individual sheathing boards.	675 lbs. per ft.
Crosswalls	Plywood sheathing applied directly over wood studs; no value should be given to plywood applied over existing plaster or wood sheathing.	1.2 times the value specified in the current building code.
	Drywall or plaster applied directly over wood studs.	The value specified in the current building code.
	Drywall or plaster applied to sheathing over existing wood studs.	50 percent of the value specified in the current building code.
Tension anchors[f]	Anchors extending entirely through unreinforced masonry wall secured with bearing plates on far side of a wall 30 square inches of area.[b, c]	5,400 lbs. per anchor for three-wythe minimum walls. 2,700 lbs. for two-wythe walls.
Shear bolts[e, f]	Anchors embedded not less than 8 inches into unreinforced masonry walls; anchors should be centered in $2^1/_2$-inch-diameter holes with dry-pack or nonshrink grout around the circumference of the anchor.	The value for plain masonry specified for solid masonry TMS 402; and no value larger than those given for $^3/_4$-inch bolts should be used.
Combined tension and shear anchors[f]	Through-anchors—anchors meeting the requirements for shear and for tension anchors.[b, c]	Tension—same as for tension anchors. Shear—same as for shear anchors.
	Embedded anchors—anchors extending to the exterior face of the wall with a $2^1/_2$-inch round plate under the head and drilled at an angle of $22^1/_2$ degrees to the horizontal; installed as specified for shear anchors.[a, b, c]	Tension—3,600 lbs. per anchor. Shear—same as for shear anchors.
Infilled walls	Reinforced masonry infilled openings in existing unreinforced masonry walls; provide keys or dowels to match reinforcing.	Same as values specified for unreinforced masonry walls.
Reinforced masonry[d]	Masonry piers and walls reinforced per the current building code.	The value specified in the current building code for strength design.
Reinforced concrete[d]	Concrete footings, walls and piers reinforced as specified in the current building code.	The value specified in the current building code for strength design.

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm^2, 1 pound = 4.4 N, 1 degree = 0.017 rad, 1 pound per foot = 14.43 N/m, 1 foot = 304.8 mm.

a. Embedded anchors to be tested as specified in Section A107.4.
b. Anchors shall be $^1/_2$ inch minimum in diameter.
c. Drilling for anchors shall be done with an electric rotary drill; impact tools should not be used for drilling holes or tightening anchors and shear bolt nuts.
d. Load factors or capacity reduction factors shall not be used.
e. Other bolt sizes, values and installation methods may be used, provided that a testing program is conducted in accordance with Section A107.5.3. The strength value shall be determined by multiplying the calculated allowable value, determined in accordance with Section A107.5.3, by 3.0, and the usable value shall be limited to not greater than 1.5 times the value given in the table. Bolt spacing shall not exceed 6 feet on center and shall be not less than 12 inches on center.
f. An alternative adhesive anchor bolt system is permitted to be used providing: its properties and installation conform to an ICC Evaluation Service Report; and the report states that the system's use is in unreinforced masonry as an acceptable alternative to Sections A107.4 and A113.1 or TMS 402, Section 2.1.4. The report's allowable values shall be multiplied by a factor of three to obtain strength values and the strength reduction factor, ϕ, shall be taken equal to 1.0.

[BS] A108.2 Masonry shear strength. The unreinforced masonry shear strength, v_{mL}, shall be determined for each masonry class from one of the following equations:

1. When testing is performed in accordance with Section A106.2.3.1, the unreinforced masonry shear strength, v_m, shall be determined by Equation A1-3.

Equation A1-3 $$_{mL} = \frac{0.75\left(0.75\ _{tL} + \frac{P_D}{A_n}\right)}{1.5}$$

The mortar shear strength values, v_{tL}, shall be determined in accordance with Section A106.2.3.6.

2. When alternate testing is performed in accordance with Section A106.2.3.3, unreinforced masonry shear, v_{mL}, shall be determined by Equation A1-4.

Equation A1-4 $$_{mL} = \frac{0.75\left(f_{sp} + \frac{P_D}{A_n}\right)}{1.5}$$

[BS] A108.3 Masonry compression. Where any increase in wall dead plus live load compression stress occurs, the maximum compression stress in unreinforced masonry, Q_G/A_n, shall not exceed 300 pounds per square inch (2070 kPa).

[BS] A108.4 Masonry tension. Unreinforced masonry shall be assumed to have no tensile capacity.

[BS] A108.5 Wall tension anchors. The tension strength of wall anchors shall be the average of the tension test values for anchors having the same wall thickness and framing orientation.

[BS] A108.6 Foundations. For existing foundations, new total dead loads are permitted to be increased over the existing dead load by 25 percent. New total dead load plus live load plus seismic forces may be increased over the existing dead load plus live load by 50 percent. Higher values may be justified only in conjunction with a geotechnical investigation.

SECTION A109—ANALYSIS AND DESIGN PROCEDURE

[BS] A109.1 General. The elements of buildings hereby required to be analyzed are specified in Table A102.1.

[BS] A109.2 Selection of procedure. Buildings with rigid diaphragms shall be analyzed by the general procedure of Section A110. Buildings with flexible diaphragms shall be analyzed by the general procedure or, where applicable, are permitted to be analyzed by the special procedure of Section A111.

SECTION A110—GENERAL PROCEDURE

[BS] A110.1 Minimum design lateral forces. Buildings shall be analyzed to resist minimum lateral forces assumed to act nonconcurrently in the direction of each of the main axes of the structure in accordance with the following:

Equation A1-5 $$V = \frac{0.75 S_{DS} W}{R}$$

[BS] A110.2 Seismic forces on elements of structures. Parts and portions of a structure not covered in Section A110.3 shall be analyzed and designed per the current building code, using force levels defined in Section A110.1.

Exceptions:

1. Unreinforced masonry walls for which height-to thickness ratios do not exceed ratios set forth in Table A110.2 need not be analyzed for out-of-plane loading. Unreinforced masonry walls that exceed the allowable *h/t* ratios of Table A110.2 shall be braced according to Section A113.5.
2. Parapets complying with Section A113.6 need not be analyzed for out-of-plane loading.
3. Where walls are to be anchored to flexible floor and roof diaphragms, the anchorage shall be in accordance with Section A113.1.

[BS] TABLE A110.2—ALLOWABLE VALUE OF HEIGHT-TO-THICKNESS RATIO OF UNREINFORCED MASONRY WALLS

WALL TYPES	$0.13g \le S_{D1} < 0.25g$	$0.25g \le S_{D1} < 0.4g$	$S_{D1} \ge 0.4g$ BUILDINGS WITH CROSSWALLS[a]	$S_{D1} \ge 0.4g$ ALL OTHER BUILDINGS
Walls of one-story buildings	20	16	16[b, c]	13
First-story wall of multiple-story building	20	18	16	15
Walls in top story of multiple-story building	14	14	14[b, c]	9
All other walls	20	16	16	13

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[BS] TABLE A110.2—ALLOWABLE VALUE OF HEIGHT-TO-THICKNESS RATIO OF UNREINFORCED MASONRY WALLS—continued

For SI:1 pound per square inch = 6894.75 N/m^2.

a. Applies to the special procedures of Section A111 only. See Section A111.7 for other restrictions.

b. This value of height-to-thickness ratio shall be used where mortar shear tests establish a tested mortar shear strength, v_t, of not less than 100 pounds per square inch. This value shall also be used where the tested mortar shear strength is not less than 60 pounds per square inch, and where a visual examination of the collar joint indicates not less than 50-percent mortar coverage.

c. Where a visual examination of the collar joint indicates not less than 50-percent mortar coverage, and the tested mortar shear strength, v_t, is greater than 30 pounds per square inch but less than 60 pounds per square inch, the allowable height-to-thickness ratio may be determined by linear interpolation between the larger and smaller ratios in direct proportion to the tested mortar shear strength.

[BS] A110.3 In-plane loading of URM shear walls and frames. Vertical seismic force-resisting elements shall be analyzed in accordance with Section A112.

[BS] A110.4 Redundancy and overstrength factors. Any redundancy or overstrength factors contained in the building code may be taken as unity. The vertical component of seismic force (E_v) may be taken as zero.

SECTION A111—SPECIAL PROCEDURE

[BS] A111.1 Limits for the application of this procedure. The special procedures of this section shall be applied only to buildings having the following characteristics:

1. Flexible diaphragms at all levels above the base of the structure.
2. Vertical elements of the seismic force-resisting system consisting predominantly of masonry or a combination of masonry and concrete shear walls.
3. Except for single-story buildings with an open front on one side only, not fewer than two lines of vertical elements of the seismic force-resisting system parallel to each axis of the building (see Section A111.8 for open front buildings).

[BS] A111.2 Seismic forces on elements of structures. With the exception of the provisions in Sections A111.4 through A111.7, elements of structures shall comply with Sections A110.2 through A110.4.

[BS] A111.3 Crosswalls. Crosswalls shall meet the requirements of this section.

[BS] A111.3.1 Crosswall definition. A crosswall is a wood-framed wall sheathed with any of the materials described in Table A108.1(1) or Table A108.1(2) or other system as defined in Section A111.3.5. Crosswalls shall be spaced not more than 40 feet (12 192 mm) on center measured perpendicular to the direction of consideration, and shall be placed in each story of the building. Crosswalls shall extend the full story height between diaphragms.

Exceptions:

1. Crosswalls need not be provided at all levels where used in accordance with Section A111.4.2, Item 4.
2. Existing crosswalls need not be continuous below a wood diaphragm at or within 4 feet (1219 mm) of grade, provided that:
   2.1. Shear connections and anchorage requirements of Section A111.5 are satisfied at all edges of the diaphragm.
   2.2. Crosswalls with total shear capacity of $0.5S_{D1}\Sigma W_d$ interconnect the diaphragm to the foundation.
   2.3. The demand-capacity ratio of the diaphragm between the crosswalls that are continuous to their foundations does not exceed 2.5, calculated as follows:

Equation A1-6
$$DCR = \frac{(2.1S_{D1}W_d + V_{ca})}{2\ {}_uD}$$

[BS] A111.3.2 Crosswall shear capacity. Within any 40 feet (12 192 mm) measured along the span of the diaphragm, the sum of the crosswall shear capacities shall be not less than 30 percent of the diaphragm shear capacity of the strongest diaphragm at or above the level under consideration.

[BS] A111.3.3 Existing crosswalls. Existing crosswalls shall have a maximum height-to-length ratio between openings of 1.5 to 1. Existing crosswall connections to diaphragms need not be investigated as long as the crosswall extends to the framing of the diaphragms above and below.

[BS] A111.3.4 New crosswalls. New crosswall connections to the diaphragm shall develop the crosswall shear capacity. New crosswalls shall have the capacity to resist an overturning moment equal to the crosswall shear capacity times the story height. Crosswall overturning moments need not be cumulative over more than two stories.

[BS] A111.3.5 Other crosswall systems. Other systems, such as moment-resisting frames, may be used as cross-walls provided that the yield story drift does not exceed 1 inch (25 mm) in any story.

[BS] A111.4 Wood diaphragms.

[BS] A111.4.1 Acceptable diaphragm span. A diaphragm is acceptable if the point (*L,DCR*) on Figure A111.4.1 falls within Region 1, 2 or 3.

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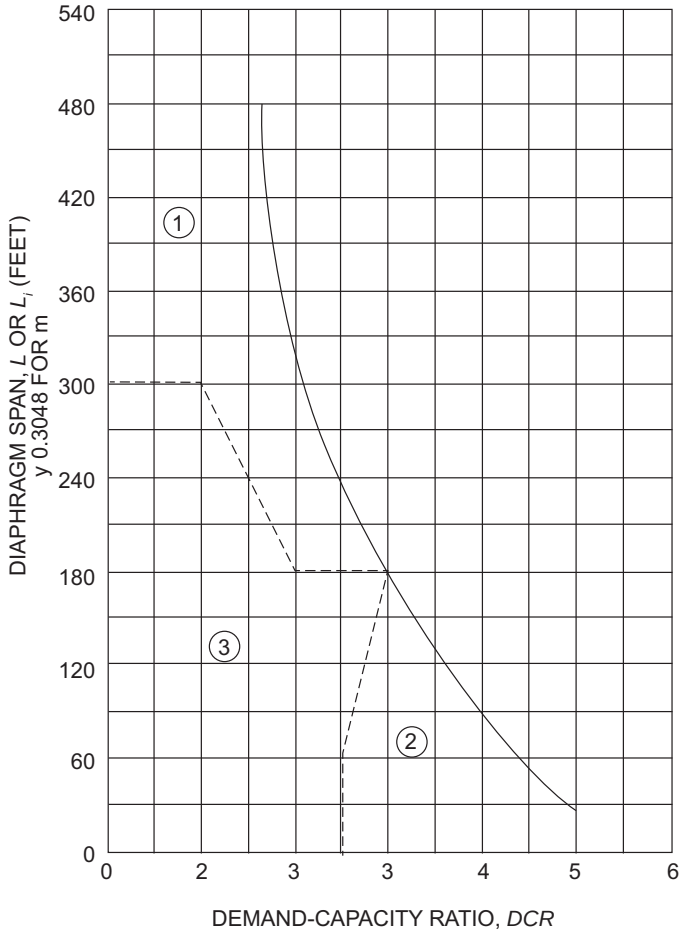
[BS] FIGURE A111.4.1—ACCEPTABLE DIAPHRAGM SPAN



1. Region of demand-capacity ratios where crosswalls may be used to increase *h/t* ratios.
2. Region of demand-capacity ratios where *h/t* ratios of "buildings with crosswalls" may be used, whether or not crosswalls are present.
3. Region of demand-capacity ratios where *h/t* ratios of "all other buildings" shall be used, whether or not crosswalls are present.

For SI: 1 foot = 304.8 mm.

[BS] A111.4.2 Demand-capacity ratios. Demand-capacity ratios shall be calculated for the diaphragm at any level according to the following formulas:

1. For a diaphragm without qualifying crosswalls at levels immediately above or below:

   Equation A1-7 $$DCR = 2.1S_{D1}W_d/\Sigma\ {}_uD$$

2. For a diaphragm in a single-story building with qualifying crosswalls, or for a roof diaphragm coupled by crosswalls to the diaphragm directly below:

   Equation A1-8 $$DCR = 2.1S_{D1}W_d/\Sigma\ {}_uD + V_{cb}$$

3. For diaphragms in a multiple-story building with qualifying crosswalls in all levels:

   Equation A1-9 $$DCR = 2.1S_{D1}\Sigma W_d/(\Sigma\Sigma\ {}_uD + V_{cb})$$

DCR shall be calculated at each level for the set of diaphragms at and above the level under consideration. In addition, the roof diaphragm shall meet the requirements of Equation A1-10.

4. For a roof diaphragm and the diaphragm directly below, if coupled by crosswalls:

   Equation A1-10 $$DCR = 2.1S_{D1}\Sigma W_d/\Sigma\Sigma\ {}_uD$$

[BS] A111.4.3 Chords. An analysis for diaphragm flexure need not be made, and chords need not be provided.

[BS] A111.4.4 Collectors. An analysis of diaphragm collector forces shall be made for the transfer of diaphragm edge shears into vertical elements of the lateral force-resisting system. Collector forces may be resisted by new or existing elements.

[BS] A111.4.5 Diaphragm openings.

1. Diaphragm forces at corners of openings shall be investigated and shall be developed into the diaphragm by new or existing materials.

2. In addition to the demand-capacity ratios of Section A111.4.2, the demand-capacity ratio of the portion of the diaphragm adjacent to an opening shall be calculated using the opening dimension as the span.
3. Where an opening occurs in the end quarter of the diaphragm span, the calculation of $v_u D$ for the demand-capacity ratio shall be based on the net depth of the diaphragm.

[BS] A111.5 Diaphragm shear transfer. Diaphragms shall be connected to shear walls and new vertical seismic force-resisting elements with connections capable of developing the diaphragm-loading tributary to the shear wall or new seismic force-resisting elements given by the lesser of the following formulas:

Equation A1-11 $V = 1.2 S_{D1} C_p W_d$

using the C_p values in Table A111.5, or

Equation A1-12 $V = {}_u D$

[BS]TABLE A111.5—HORIZONTAL FORCE FACTOR, C_p

CONFIGURATION OF MATERIALS	C_p
Roofs with straight or diagonal sheathing and roofing applied directly to the sheathing, or floors with straight tongue-and-groove sheathing.	0.50
Diaphragms with double or multiple layers of boards with edges offset, and blocked plywood systems.	0.75
Diaphragms of metal deck without topping:	
Minimal welding or mechanical attachment.	0.6
Welded or mechanically attached for seismic resistance.	0.68

[BS] A111.6 Shear walls (in-plane loading).

[BS] A111.6.1 Wall story force. The wall story force distributed to a shear wall at any diaphragm level shall be the lesser value calculated as:

Equation A1-13 $F_{wx} = 0.8 S_{D1}(W_{wx} + W_d/2)$

but need not exceed

Equation A1-14 $F_{wx} = 0.8 S_{D1} W_{wx} + {}_u D$

[BS] A111.6.2 Wall story shear. The wall story shear shall be the sum of the wall story forces at and above the level of consideration.

Equation A1-15 $V_{wx} = \Sigma F_{wx}$

[BS] A111.6.3 Shear wall analysis. Shear walls shall comply with Section A112.

[BS] A111.6.4 New seismic force-resisting elements. New seismic force-resisting elements such as moment frames, braced frames or shear walls shall be designed as required by the building code, except that the seismic forces shall be as specified in Section A111.6.1, and the story drift ratio shall be limited to 0.015, except as further limited by Section A112.4.2 for moment frames.

[BS] A111.7 Out-of-plane forces—unreinforced masonry walls.

[BS] A111.7.1 Allowable unreinforced masonry wall height-to-thickness ratios. The provisions of Section A110.2 are applicable, except the allowable height-to-thickness ratios given in Table A110.2 shall be determined from Figure A111.4.1 as follows:

1. In Region 1, height-to-thickness ratios for buildings with crosswalls may be used if qualifying crosswalls are present in all stories.
2. In Region 2, height-to-thickness ratios for buildings with crosswalls may be used whether or not qualifying crosswalls are present.
3. In Region 3, height-to-thickness ratios for “all other buildings” shall be used whether or not qualifying crosswalls are present.

[BS] A111.7.2 Walls with diaphragms in different regions. Where diaphragms above and below the wall under consideration have demand-capacity ratios in different regions of Figure A111.4.1, the lesser height-to-thickness ratio shall be used.

[BS] A111.8 Open-front design procedure. A single-story building with an open front on one side and crosswalls parallel to the open front may be designed by the following procedure:

1. Effective diaphragm span, L_i, for use in Figure A111.4.1 shall be determined in accordance with the following formula:

   Equation A1-16 $L_i = 2[(W_w/W_d)L + L]$

2. Diaphragm demand-capacity ratio shall be calculated as:

   Equation A1-17 $DCR = 2.1 S_{D1}(W_d + W_w)/[(v_u D) + V_{cb}]$

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SECTION A112—ANALYSIS AND DESIGN

[BS] A112.1 General. The following requirements are applicable to both the general procedure and the special procedure for analyzing vertical elements of the lateral force-resisting system.

[BS] A112.2 In-plane shear of unreinforced masonry walls.

[BS] A112.2.1 Flexural rigidity. Flexural components of deflection need not be considered in determining the rigidity of an unreinforced masonry wall.

[BS] A112.2.2 Shear walls with openings. Wall piers shall be analyzed according to the following procedure, which is diagrammed in Figure A112.2.2.

1. For any pier:
   1.1. The pier shear capacity shall be calculated as:

   Equation A1-18 $v_a = v_m A_n$

   where:

   A_n = area of net mortared or grouted section of a wall or wall pier.

   1.2. The pier rocking shear capacity shall be calculated as:

   Equation A1-19 $V_r = 0.9 P_D D/H$
2. The wall piers at any level are acceptable if they comply with one of the following modes of behavior:
   2.1. Rocking controlled mode. Where the pier rocking shear capacity is less than the pier shear capacity, in other words, $V_r < v_a$, for each pier in a level, forces in the wall at that level, V_{wx}, shall be distributed to each pier in proportion to $P_D D/H$.

   For the wall at that level:

   Equation A1-20 $0.7 V_{wx} < S V_r$

   2.2. Shear controlled mode. Where the pier shear capacity is less than the pier rocking capacity, in other words, $v_a < V_r$ in one or more pier(s) in a level, forces in the wall at the level, V_{wx}, shall be distributed to each pier in proportion to D/H.

   For each pier at that level:

   Equation A1-21 $V_p < v_a$

   and

   Equation A1-22 $V_p < V_r$

   If $V_p < v_a$ for each pier and $V_p > V_r$ for one or more piers, such piers shall be omitted from the analysis, and the procedure shall be repeated for the remaining piers, unless the wall is strengthened and reanalyzed.
3. Masonry pier tension stress. Unreinforced masonry wall piers need not be analyzed for tension stress.

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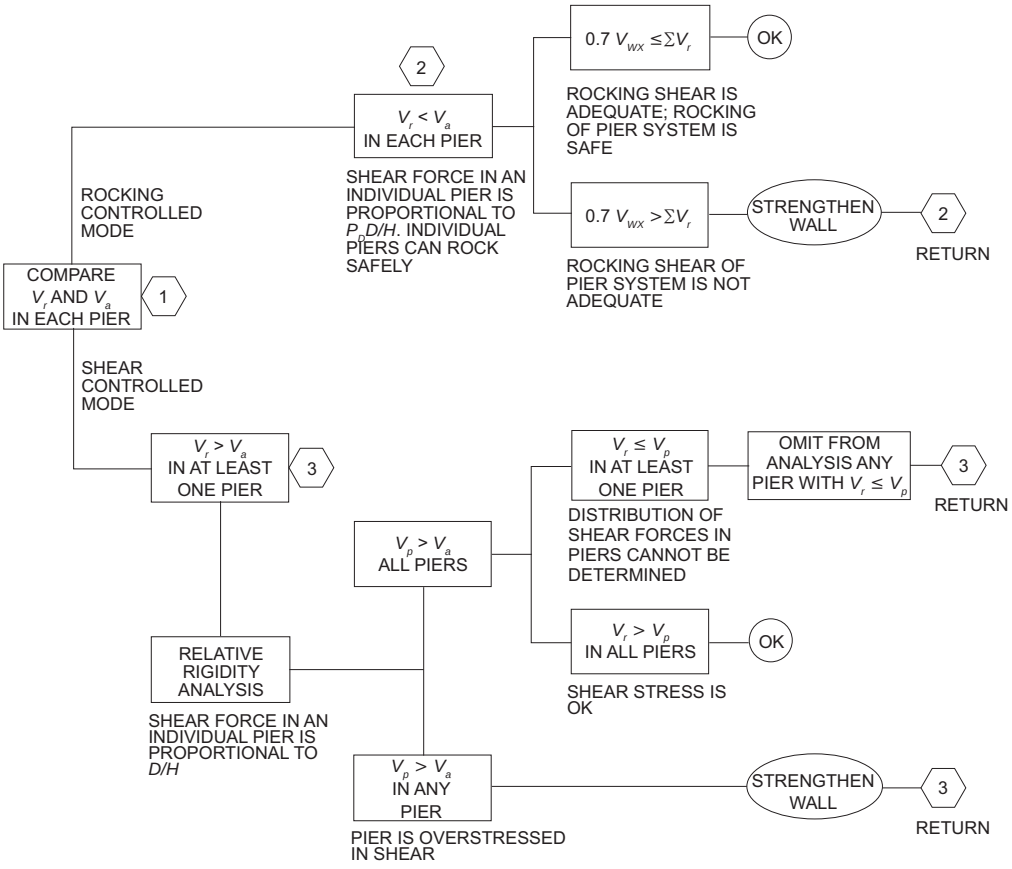
[BS] FIGURE A112.2.2—ANALYSIS OF URM WALL IN-PLANE SHEAR FORCES


COMPARE V_r AND V_a IN EACH PIER
1
ROCKING CONTROLLED MODE
SHEAR CONTROLLED MODE
2
$V_r < V_a$ IN EACH PIER
SHEAR FORCE IN AN INDIVIDUAL PIER IS PROPORTIONAL TO $P_D D/H$. INDIVIDUAL PIERS CAN ROCK SAFELY
$0.7\ V_{wx} \le \Sigma V_r$
OK
ROCKING SHEAR IS ADEQUATE; ROCKING OF PIER SYSTEM IS SAFE
$0.7\ V_{wx} > \Sigma V_r$
STRENGTHEN WALL
2
RETURN
ROCKING SHEAR OF PIER SYSTEM IS NOT ADEQUATE
$V_r > V_a$ IN AT LEAST ONE PIER
3
RELATIVE RIGIDITY ANALYSIS
SHEAR FORCE IN AN INDIVIDUAL PIER IS PROPORTIONAL TO D/H
$V_p > V_a$ ALL PIERS
$V_r \le V_p$ IN AT LEAST ONE PIER
OMIT FROM ANALYSIS ANY PIER WITH $V_r \le V_p$
3
RETURN
DISTRIBUTION OF SHEAR FORCES IN PIERS CANNOT BE DETERMINED
$V_r > V_p$ IN ALL PIERS
OK
SHEAR STRESS IS OK
$V_p > V_a$ IN ANY PIER
STRENGTHEN WALL
3
RETURN
PIER IS OVERSTRESSED IN SHEAR

V_a = Allowable shear strength of a pier.
V_p = Shear force assigned to a pier on the basis of a relative shear rigidity analysis.
V_r = Rocking shear capacity of pier.
V_{wx} = Total shear force resisted by the wall.
ΣV_r = Rocking shear capacity of all piers in the wall.

[BS] A112.2.3 Shear walls without openings. Shear walls without openings shall be analyzed the same as for walls with openings, except that V_r shall be calculated as follows:

Equation A1-23 $V_r = 0.9(P_D + 0.5P_w)D/H$

[BS] A112.3 Plywood-sheathed shear walls. Plywood-sheathed shear walls may be used to resist lateral forces for URM buildings with flexible diaphragms analyzed according to provisions of Section A111. Plywood-sheathed shear walls shall not be used to share lateral forces with other materials along the same line of resistance.

[BS] A112.4 Combinations of vertical elements.

[BS] A112.4.1 Seismic force distribution. Seismic forces shall be distributed among the vertical-resisting elements in proportion to their relative rigidities, except that moment-resisting frames shall comply with Section A112.4.2.

[BS] A112.4.2 Moment-resisting frames. Moment resisting frames shall not be used with an unreinforced masonry wall in a single line of resistance unless the wall has piers that have adequate shear capacity to sustain rocking in accordance with Section A112.2.2. The frames shall be designed in accordance with the building code to resist 100 percent of the seismic forces tributary to that line of resistance, as determined from Section A111.2. The story drift ratio shall be limited to 0.0075.

SECTION A113—DETAILED BUILDING SYSTEM DESIGN REQUIREMENTS

[BS] A113.1 Wall anchorage.

[BS] A113.1.1 Anchor locations. Unreinforced masonry walls shall be anchored at the roof and floor levels as required in Section A110.2. Ceilings of plaster or similar materials, where not attached directly to roof or floor framing and where abutting masonry walls, shall either be anchored to the walls at a maximum spacing of 6 feet (1829 mm) or be removed.

[BS] A113.1.2 Anchor requirements. Anchors shall consist of bolts installed through the wall as specified in Table A108.1(2), or an *approved* equivalent at a maximum anchor spacing of 6 feet (1829 mm). Wall anchors shall be secured to the framing members parallel or perpendicular to the wall to develop the required forces.

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[BS] A113.1.3 Minimum wall anchorage. Anchorage of masonry walls to each floor or roof shall resist a minimum force determined as $0.9S_{DS}$ times the tributary weight or 200 pounds per linear foot (2920 N/m), whichever is greater, acting normal to the wall at the level of the floor or roof. Existing wall anchors, if used, must be tested and meet the requirements of Section A107.5.1 or be upgraded.

[BS] A113.1.4 Anchors at corners. At the roof and floor levels, both shear and tension anchors shall be provided within 2 feet (610 mm) horizontally from the inside of the corners of the walls.

[BS] A113.2 Diaphragm shear transfer. Anchors transmitting shear forces shall have a maximum spacing of 6 feet (1829 mm) and shall have nuts installed over malleable iron or plate washers where bearing on wood, and heavy-cut washers where bearing on steel.

[BS] A113.3 Collectors. Collector elements shall be provided that are capable of transferring the seismic forces originating in other portions of the building to the element providing the resistance to those forces.

[BS] A113.4 Ties and continuity. Ties and continuity shall conform to the requirements of the building code.

[BS] A113.5 Wall bracing.

[BS] A113.5.1 General. Where a wall height-to-thickness ratio exceeds the specified limits, the wall may be laterally supported by vertical bracing members per Section A113.5.2 or by reducing the wall height by bracing per Section A113.5.3.

[BS] A113.5.2 Vertical bracing members. Vertical bracing members shall be attached to floor and roof construction for their design loads independently of required wall anchors. Horizontal spacing of vertical bracing members shall not exceed one-half of the unsupported height of the wall or 10 feet (3048 mm). Deflection of such bracing members at design loads shall not exceed one-tenth of the wall thickness.

[BS] A113.5.3 Intermediate wall bracing. The wall height may be reduced by bracing elements connected to the floor or roof. Horizontal spacing of the bracing elements and wall anchors shall be as required by design, but shall not exceed 6 feet (1829 mm) on center. Bracing elements shall be detailed to minimize the horizontal displacement of the wall by the vertical displacement of the floor or roof.

[BS] A113.6 Parapets. Parapets and exterior wall appendages not conforming to this chapter shall be removed, or stabilized or braced to ensure that the parapets and appendages remain in their original positions.

The maximum height of an unbraced unreinforced masonry parapet above the lower of either the level of tension anchors or the roof sheathing shall not exceed the height-to-thickness ratio shown in Table A113.6. If the required parapet height exceeds this maximum height, a bracing system designed for the forces determined in accordance with the building code shall support the top of the parapet. Parapet corrective work must be performed in conjunction with the installation of tension roof anchors.

The height of a URM parapet above any wall anchor shall be not less than 12 inches (305 mm).

Exception: If a reinforced concrete beam is provided at the top of the wall, the height above the wall anchor is permitted to be not less than 6 inches (152 mm).

[BS] TABLE A113.6—MAXIMUM ALLOWABLE HEIGHT-TO-THICKNESS RATIO FOR PARAPETS

	S_{D1}		
	$0.13g \le S_{D1} \le 0.25g$	$0.25g \le S_{D1} < 0.4g$	$S_{D1} \ge 0.4g$
Maximum allowable height-to-thickness ratios	2.5	2.5	1.5

[BS] A113.7 Veneer.

1. Veneer shall be anchored with *approved* anchor ties conforming to the required design capacity specified in the building code and shall be placed at a maximum spacing of 24 inches (610 mm) with a maximum supported area of 4 square feet (0.372 m^2).

   Exception: Existing anchor ties for attaching brick veneer to brick backing shall be acceptable, provided that the ties are in good condition and conform to the following minimum size and material requirements.

   Existing veneer anchor ties shall be considered adequate if they are of corrugated galvanized iron strips not less than 1 inch (25 mm) in width, 8 inches (203 mm) in length and $^1/_{16}$ inch (1.6 mm) in thickness, or the equivalent.

2. The location and condition of existing veneer anchor ties shall be verified as follows:
   - 2.1. An *approved* testing laboratory shall verify the location and spacing of the ties and shall submit a report to the *code official* for approval as part of the structural analysis.
   - 2.2. The veneer in a selected area shall be removed to expose a representative sample of ties (not less than four) for inspection by the *code official*.

[BS] A113.8 Nonstructural masonry walls. Unreinforced masonry walls that do not carry design vertical or lateral loads and that are not required by the design to be part of the lateral force-resisting system shall be adequately anchored to new or existing supporting elements. The anchors and elements shall be designed for the out-of-plane forces specified in the building code. The height- or length-to-thickness ratio between such supporting elements for such walls shall not exceed nine.

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[BS] A113.9 Truss and beam supports. Where trusses and beams other than rafters or joists are supported on masonry, independent secondary columns shall be installed to support vertical loads of the roof or floor members.

Exception: Secondary supports are not required where S_{D1} is less than 0.3g.

[BS] A113.10 Adjacent buildings. Where elements of adjacent buildings do not have a separation of 5 inches (127 mm) or greater, the allowable height-to-thickness ratios for "all other buildings" per Table A110.2 shall be used in the direction of consideration.

SECTION A114—WALLS OF UNBURNED CLAY, ADOBE OR STONE MASONRY

[BS] A114.1 General. Walls of unburned clay, adobe or stone masonry construction shall conform to the following:

1. Walls of unburned clay, adobe or stone masonry shall not exceed a height- or length-to-thickness ratio specified in Table A114.1.
2. Adobe shall be allowed a maximum value of 9 pounds per square inch (62.1 kPa) for shear unless higher values are justified by test.
3. Mortar for repointing may be of the same soil composition and stabilization as the brick, in lieu of cement mortar.

[BS]TABLE A114.1—MAXIMUM HEIGHT-TO-THICKNESS RATIO FOR ADOBE OR STONE WALLS

	S_{D1}		
	$0.13g \le S_{D1} < 0.25g$	$0.25g \le S_{D1} < 0.4g$	$S_{D1} \ge 0.4g$
One-story buildings	12	10	8
Two-story buildings			
First story	14	11	9
Second story	12	10	8

CHAPTER A2
EARTHQUAKE HAZARD REDUCTION IN EXISTING REINFORCED CONCRETE AND REINFORCED MASONRY WALL BUILDINGS WITH FLEXIBLE DIAPHRAGMS

SECTION A201—PURPOSE

[BS] A201.1 Purpose. The purpose of this chapter is to promote public safety and welfare by reducing the risk of death or injury as a result of the effects of earthquakes on reinforced concrete and reinforced masonry wall buildings with flexible diaphragms. Based on past earthquakes, these buildings have been categorized as being potentially hazardous and prone to significant damage, including possible collapse in a moderate to major earthquake. The provisions of this chapter are minimum standards for structural seismic resistance established primarily to reduce the risk of life loss or injury on both subject and adjacent properties. These provisions will not necessarily prevent loss of life or injury, or prevent earthquake damage to an *existing building* that complies with these standards.

SECTION A202—SCOPE

[NY] A202.1 Scope. The provisions of this chapter shall apply to wall anchorage systems that resist out-of-plane forces and to collectors in existing reinforced concrete or reinforced masonry buildings with flexible diaphragms. Wall anchorage systems that were designed and constructed in accordance with the 1997 *Uniform Building Code* or the 2000 or subsequent editions of the *International Building Code and Building Code of New York State* shall be deemed to comply with these provisions.

SECTION A203—DEFINITIONS

[BS] A203.1 Definitions. For the purpose of this chapter, the applicable definitions in the *Building Code of New York State* and the following shall apply:

[BS] CONTINUITY CONNECTOR. A component, typically a plate, rod, strap or hold-down, that ensures load path continuity along the full length of a crosstie or strut.

[BS] CROSSTIE. A member or group of members continuous across the main diaphragm that connects opposite wall lines and transfers out-of-plane wall anchorage forces into the diaphragm.

[BS] FLEXIBLE DIAPHRAGM. A roof or floor sheathed with plywood, wood decking (1-by or 2-by) or metal deck without a concrete topping slab.

[BS] STRUT. A member or group of members continuous across a subdiaphragm that transfers out-of-plane wall anchorage forces into the subdiaphragm.

[BS] WALL ANCHORAGE SYSTEM. The components comprising a complete load path for out-of-plane wall forces from the wall to the main diaphragm, typically including anchors embedded in or fastened to the wall; rods, straps, plates, hold-downs or other hardware; subdiaphragms and their chords; crossties; struts; and continuity connectors.

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[BS] WALL SEGMENT. Any length of concrete wall with continuous horizontal reinforcing and not interrupted or intersected by a pilaster or vertical construction joint, or any length of reinforced masonry wall with continuous horizontal reinforcing and not interrupted or intersected by a pilaster or vertical control joint.

SECTION A204—SYMBOLS AND NOTATIONS

[BS] A204.1 General. For the purpose of this chapter, the applicable symbols and notations in the *Building Code of New York State* shall apply.

SECTION A205—GENERAL REQUIREMENTS

[BS] A205.1 General. The seismic-resisting elements specified in this chapter shall comply with applicable provisions of *Section 1613* of the *Building Code of New York State* and Chapter 12 of ASCE 7, except as modified herein.

[BS] A205.2 Requirements for plans. The plans shall accurately reflect the results of the engineering investigation and design and shall show all pertinent dimensions and sizes for plan review and construction. The following shall be provided:

1. Floor plans and roof plans shall show existing framing construction, diaphragm construction, proposed wall anchors, crossties and collectors. Existing nailing, anchors, crossties and collectors shall be shown on the plans if they are considered part of the lateral force-resisting systems.
2. Typical wall panel details and sections with panel thickness, height, pilasters and location of anchors shall be provided.
3. Details shall include existing and new anchors and the method of developing anchor forces into the diaphragm framing, existing and new crossties, and existing and new or improved support of roof and floor girders at pilasters or walls.
4. The basis for design and the building code used for the design shall be stated on the plans.

[BS] A205.3 Structural observation. Structural observation, in accordance with Section 1704.6 of the *Building Code of New York State* is required, regardless of seismic design category, height or other conditions. Structural observation shall include visual observation of work for conformance to the *approved* construction documents and confirmation of existing conditions assumed during design.

A205.3.1 Additional special inspection. In addition to the requirements of Section 1705.13 of the *Building Code of New York State*, special inspection shall be required for:

1. Installation of anchors into existing concrete or masonry walls to form part of a wall anchorage system.
2. Fastening of new or existing steel deck forming part of a wall anchorage system.
3. Installation of continuity connectors along the length of crossties, to ensure compliance with Section A206.2. This inspection may be periodic special inspection.

A205.3.2 Testing to establish adequacy of existing wall anchors. Testing shall show that the existing anchors can sustain a test load of 1.5 times the design tension load without noticeable deformation or damage to the anchor, to the masonry or concrete element, or to any part of the existing load path between the anchor and new retrofit components. Three anchors of each existing detail type shall be tested, and all three shall satisfy the requirement. Prior to testing, the design professional shall submit a test plan for *code official* approval identifying the expected locations of the existing anchors in question, the locations of the proposed tests, and the test procedure and criteria. After testing, the design professional shall submit a report of the satisfactory testing showing the test results, the design strengths derived from them, and the size and spacing as confirmed by investigation.

A205.4 Testing and Inspection. Structural testing and inspection for new construction materials, submittals, reports and certificates of compliance shall be in accordance with Sections 1704 and 1705 of the *Building Code of New York State*. Work done to comply with this chapter shall not be eligible for Exception 1 to Section 1704.2 of the *Building Code of New York State* or Exception 2 to Section 1705.13 of the *Building Code of New York State*.

SECTION A206—ANALYSIS AND DESIGN

[BS] A206.1 Reinforced concrete and reinforced masonry wall anchorage. Concrete and masonry walls shall be anchored to all floors and roofs that provide lateral support for the wall in accordance with Section 12.11.2 of ASCE 7. The anchorage shall provide a direct connection capable of resisting 75 percent of the forces specified in Section 12.11.2.1 of ASCE 7.

Exceptions:

1. Existing walls need not be evaluated or retrofitted for bending between anchors.
2. Work required by this chapter need not consider shrinkage, thermal changes or differential settlement.

A206.1.1 Seismicity parameters, site class and geologic hazards. For any site designated as Site Class E, the value of F_a shall be taken as 1.2. Site-specific procedures are not required for compliance with this chapter. Mitigation of existing geologic site hazards such as liquefiable soil, fault rupture or landslide is not required for compliance with this chapter.

[BS] A206.2 Additional requirements for wall anchorage systems. The wall anchorage system shall comply with the requirements of this section and Section 12.11.2.2 of ASCE 7.

The maximum spacing between wall anchors shall be 8 feet (2438 mm), and each wall segment shall have at least two wall anchors.

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The wall anchorage system, excluding subdiaphragms and existing roof or floor framing members, shall be designed and installed to limit the relative movement between the wall and the diaphragm to no more than $^1/_8$ inch before engagement of the anchors. Wall anchors shall be provided to resist out-of-plane forces, independent of existing shear anchors.

Where new members are added as crossties, they shall be spaced no more than 24 feet (7315 mm) apart. Where existing girders are used as crossties, their actual spacing shall be deemed adequate even where the spacing exceeds 24 feet (7315 mm), as long as the girders are provided with continuity connectors as required.

Wall anchorage shall not be provided by fastening the edge of plywood sheathing to steel ledgers. Wall anchorage shall not be provided solely by fastening the edge of steel decking to steel ledgers unless analysis demonstrates acceptable capacity. The existing connections shall be subject to field verification and the new connections shall be subject to special inspection.

New wall anchors shall be provided to resist the full wall anchorage design force independent of existing shear or tension anchors.

Exception: Existing cast-in-place anchors shall be permitted as part of the wall anchorage system if the tie element can be readily attached to the anchors, and if the anchors are capable of resisting the total vertical and lateral shear load (including dead load) while being acted on by the maximum wall anchorage tension force caused by an earthquake. Acceptable tension values for the existing anchors shall be established by testing in accordance with Section A205.4.

[BS] A206.3 Development of anchor forces into the diaphragm. Development of the required anchorage forces into roof and floor diaphragms shall comply with the requirements of this section and Section 12.11.2.2 of ASCE 7.

Lengths of development of anchor loads in wood diaphragms shall be based on existing field nailing of the sheathing unless existing edge nailing is positively identified on the original construction plans or at the site.

[BS] A206.4 Anchorage at pilasters. Where pilasters are present, the wall anchorage system shall comply with the requirements of this section and Section 12.11.2.2.7 of ASCE 7. The pilasters or the walls immediately adjacent to the pilasters shall be anchored directly to the roof framing such that the existing vertical anchor bolts at the top of the pilasters are bypassed without permitting tension or shear failure at the top of the pilasters.

Exception: If existing vertical anchor bolts at the top of the pilasters are used for the anchorage, additional exterior confinement shall be provided as required to resist the total anchorage force.

[BS] A206.5 Combination of anchor types. New anchors used in combination on a single framing member shall be of compatible behavior and stiffness.

[BS] A206.6 Anchorage at interior walls. Existing interior reinforced concrete or reinforced masonry walls that extend to the floor above or to the roof diaphragm shall be anchored for out-of-plane forces per Sections A206.1 and A206.3. Walls extending through the roof diaphragm shall be anchored for out-of-plane forces on both sides, and continuity ties shall be spliced across or continuous through the interior wall to provide diaphragm continuity.

[BS] A206.7 Collectors. Collectors designed in accordance with this section shall be provided at reentrant corners and at interior shear walls. Existing or new collectors shall have the capacity to develop into the diaphragm a force equal to the lesser of the rocking or shear capacity of the reentrant wall or the tributary shear based on 75 percent of the diaphragm design forces specified in Section 12.10 of ASCE 7. The capacity of the collector need not exceed the capacity of the diaphragm to deliver loads to the collector. A connection shall be provided from the collector to the reentrant wall to transfer the full collector internal force. If a truss or beam other than a rafter or purlin is supported by the reentrant wall or by a column integral with the reentrant wall, then an independent secondary column is required to support the roof or floor members whenever rocking or shear capacity of the reentrant wall is less than the tributary shear.

[BS] A206.8 Mezzanines. Existing mezzanines relying on reinforced concrete or reinforced masonry walls for vertical or lateral support shall be anchored to the walls for the tributary mezzanine load. Walls depending on the mezzanine for lateral support shall be anchored per Sections A206.1, A206.2 and A206.3.

Exception: Existing mezzanines that have independent lateral and vertical support need not be anchored to the walls.

SECTION A207—MATERIALS OF CONSTRUCTION

[BS] A207.1 Materials. Materials permitted by the building code, including their appropriate strength or allowable stresses, shall be used to meet the requirements of this chapter.

CHAPTER A3
PRESCRIPTIVE PROVISIONS FOR SEISMIC STRENGTHENING OF CRIPPLE WALLS AND SILL PLATE ANCHORAGE OF LIGHT, WOOD-FRAME RESIDENTIAL BUILDINGS

SECTION A301—GENERAL

[BS] A301.1 Purpose. The provisions of this chapter are intended to promote public safety and welfare by reducing the risk of earthquake-induced damage to existing wood-frame residential buildings. The requirements contained in this chapter are prescriptive minimum standards intended to improve the seismic performance of residential buildings; however, they will not necessarily prevent earthquake damage.

This chapter sets standards for strengthening that may be *approved* by the *code official* without requiring plans or calculations prepared by a registered design professional. The provisions of this chapter are not intended to prevent the use of any material or

method of construction not prescribed herein. The *code official* may require that construction documents for strengthening using alternative materials or methods be prepared by a registered design professional.

[BS] A301.2 Scope. The provisions of this chapter apply to residential buildings of light-frame wood construction containing one or more of the structural weaknesses specified in Section A303.

Exception: The provisions of this chapter do not apply to the buildings, or elements thereof, listed as follows. These buildings or elements require analysis by a registered design professional in accordance with Section A301.3 to determine appropriate strengthening:

1. Group R-1.
2. Group R with more than four dwelling units.
3. Buildings with a lateral force-resisting system using poles or columns embedded in the ground.
4. Cripple walls that exceed 4 feet (1219 mm) in height.
5. Buildings exceeding three stories in height and any three-story building with cripple wall studs exceeding 14 inches (356 mm) in height.
6. Buildings where the *code official* determines that conditions exist that are beyond the scope of the prescriptive requirements of this chapter.
7. Buildings or portions thereof constructed on concrete slabs on grade.

[BS] A301.3 Alternative design procedures. The details and prescriptive provisions herein are not intended to be the only acceptable strengthening methods permitted. Alternative details and methods shall be permitted to be used where *approved* by the *code official*. Approval of alternatives shall be based on a demonstration that the method or material used is at least equivalent in terms of strength, deflection and capacity to that provided by the prescriptive methods and materials.

Where analysis by a registered design professional is required, such analysis shall be in accordance with all requirements of the building code, except that the seismic forces may be taken as 75 percent of those specified in the *Building Code of New York State*.

SECTION A302—DEFINITIONS

[BS] A302.1 Definitions. For the purpose of this chapter, in addition to the applicable definitions in the building code, certain additional terms are defined as follows:

[BS] ADHESIVE ANCHOR. An assembly consisting of a threaded rod, washer, nut, and chemical adhesive *approved* by the *code official* for installation in existing concrete or masonry.

[BS] CRIPPLE WALL. A wood-frame stud wall extending from the top of the foundation to the underside of the *lowest floor* framing.

[BS] EXPANSION ANCHOR. An *approved* post-installed anchor, inserted into a predrilled hole in existing concrete or masonry, that transfers loads to or from the concrete or masonry by direct bearing or friction or both.

[BS] PERIMETER FOUNDATION. A foundation system that is located under the exterior walls of a building.

[BS] SNUGTIGHT. As tight as an individual can torque a nut on a bolt by hand, using a wrench with a 10-inch-long (254 mm) handle, and the point at which the full surface of the plate washer is contacting the wood member and slightly indenting the wood surface.

[BS] WOOD STRUCTURAL PANEL. A panel manufactured from veneers, wood strands or wafers or a combination of veneer and wood strands or wafers bonded together with waterproof synthetic resins or other suitable bonding systems. Examples of wood structural panels are:

Composite panels. A wood structural panel that is comprised of wood veneer and reconstituted wood-based material and bonded together with waterproof adhesive.

Oriented strand board (OSB). A mat-formed wood structural panel comprised of thin rectangular wood strands arranged in cross-aligned layers with surface layers normally arranged in the long panel direction and bonded with waterproof adhesive.

Plywood. A wood structural panel comprised of plies of wood veneer arranged in cross-aligned layers. The plies are bonded with waterproof adhesive that cures on application of heat and pressure.

SECTION A303—STRUCTURAL WEAKNESSES

[BS] A303.1 General. For the purposes of this chapter, any of the following conditions shall be deemed a structural weakness:

1. Sill plates or floor framing that are supported directly on the ground without a foundation system that conforms to the building code.
2. A perimeter foundation system that is constructed only of wood posts supported on isolated pad footings.
3. Perimeter foundation systems that are not continuous.

   Exceptions:

   1. Existing single-story exterior walls not exceeding 10 feet (3048 mm) in length, forming an extension of floor area beyond the line of an existing continuous perimeter foundation.
   2. Porches, storage rooms and similar spaces not containing fuel-burning appliances.
4. A perimeter foundation system that is constructed of unreinforced masonry or stone.

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5. Sill plates that are not connected to the foundation or that are connected with less than what is required by the building code.

   Exception: Where *approved* by the *code official*, connections of a sill plate to the foundation made with other than sill bolts shall be accepted if the capacity of the connection is equivalent to that required by the building code.

6. Cripple walls that are not braced in accordance with the requirements of Section A304.4 and Table A304.3.1, or cripple walls not braced with diagonal sheathing or wood structural panels in accordance with the building code.

SECTION A304—STRENGTHENING REQUIREMENTS

[BS] A304.1 General.

[BS] A304.1.1 Scope. The structural weaknesses noted in Section A303 shall be strengthened in accordance with the requirements of this section. Strengthening work may include both new construction and *alteration* of existing construction. Except as provided herein, all strengthening work and materials shall comply with the applicable provisions of the *Building Code of New York State*.

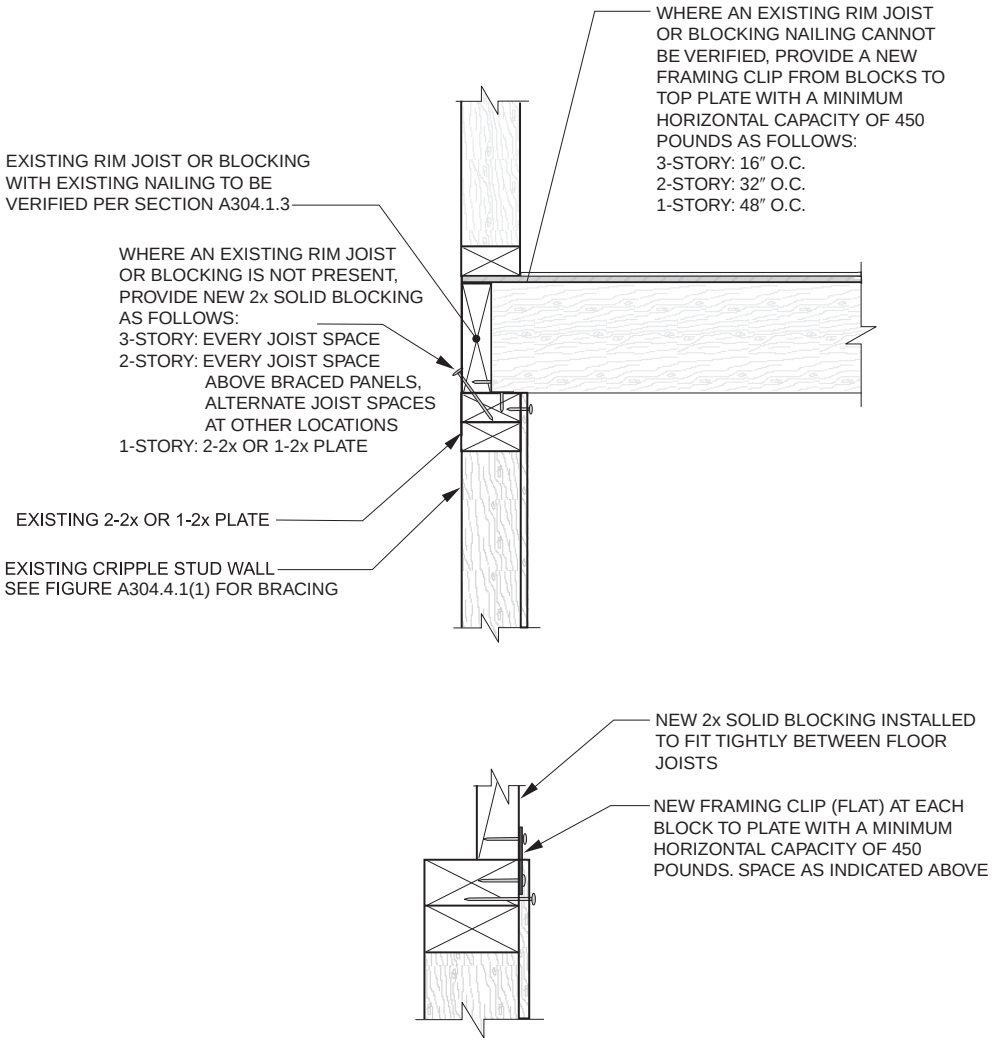
[BS] A304.1.2 Condition of existing wood materials. Existing wood materials that will be a part of the strengthening work (such as sills, studs and sheathing) shall be in a sound condition and free from defects that substantially reduce the capacity of the member. Any wood material found to contain fungus infection shall be removed and replaced with new material. Any wood material found to be infested with insects or to have been infested with insects shall be strengthened or replaced with new materials to provide a net dimension of sound wood equal to or greater than its undamaged original dimension.

[BS] A304.1.3 Floor joists not parallel to foundations. Floor joists framed perpendicular or at an angle to perimeter foundations shall be restrained either by an existing nominal 2-inch-wide (51 mm) continuous rim joist or by a nominal 2-inch-wide (51 mm) full-depth block between alternate joists in one- and two-story buildings, and between each joist in three-story buildings. Existing blocking for multiple-story buildings must occur at each joist space above a braced cripple wall panel.

Existing connections at the top and bottom edges of an existing rim joist or blocking need not be verified in one story buildings. In multiple-story buildings, the existing top edge connection need not be verified; however, the bottom edge connection to either the foundation sill plate or the top plate of a cripple wall shall be verified. The minimum existing bottom edge connection shall consist of 8d toenails spaced 6 inches (152 mm) apart for a continuous rim joist, or three 8d toenails per block. Where this minimum bottom edge-connection is not present or cannot be verified, a supplemental connection installed as shown in Figure A304.1.3 or A304.1.4(2) shall be provided.

Where an existing continuous rim joist or the minimum existing blocking does not occur, new $^{3}/_{4}$-inch (19.1 mm) or $^{23}/_{32}$-inch (18 mm) wood structural panel blocking installed tightly between floor joists and nailed as shown in Figure A304.1.4(3) shall be provided at the inside face of the cripple wall. In lieu of wood structural panel blocking, tight fitting, full-depth 2-inch (51 mm) blocking may be used. New blocking may be omitted where it will interfere with vents or plumbing that penetrates the wall.

[BS] FIGURE A304.1.3—TYPICAL FLOOR TO CRIPPLE WALL CONNECTION (FLOOR JOISTS NOT PARALLEL TO FOUNDATIONS)

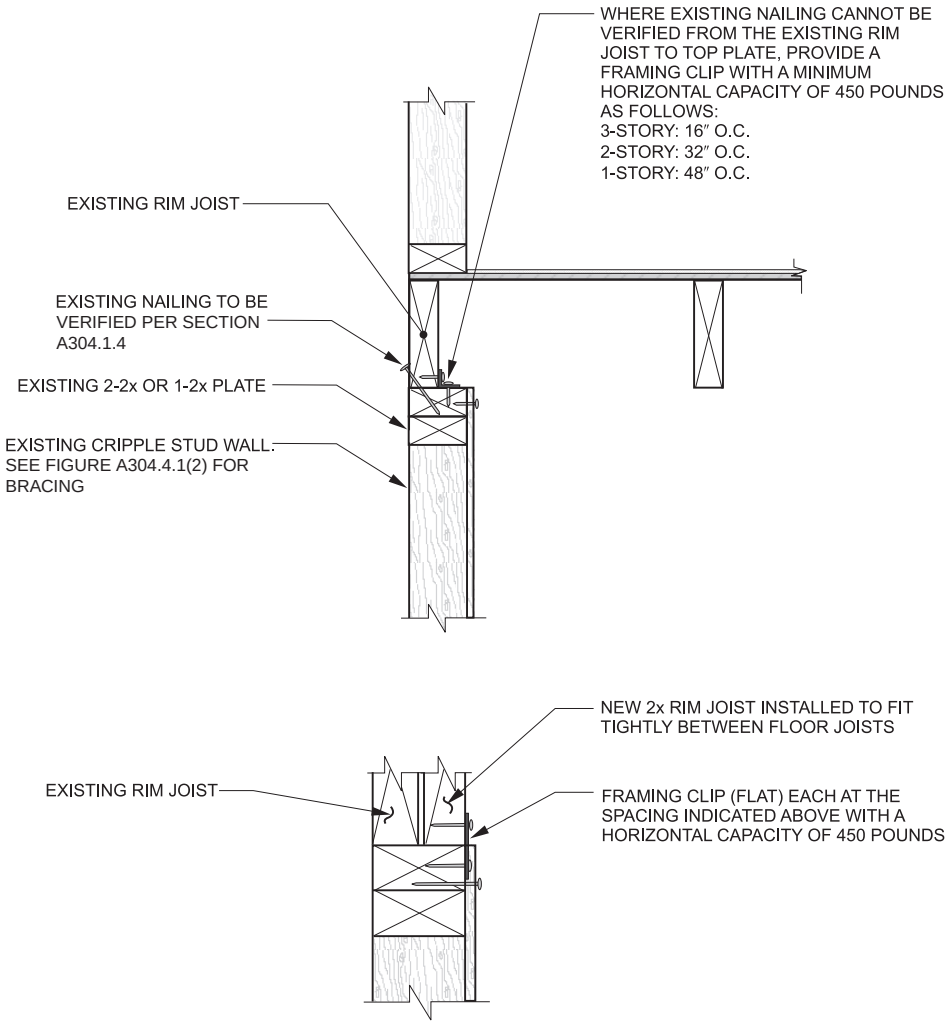

WHERE AN EXISTING RIM JOIST OR BLOCKING NAILING CANNOT BE VERIFIED, PROVIDE A NEW FRAMING CLIP FROM BLOCKS TO TOP PLATE WITH A MINIMUM HORIZONTAL CAPACITY OF 450 POUNDS AS FOLLOWS:
3-STORY: 16″ O.C.
2-STORY: 32″ O.C.
1-STORY: 48″ O.C.
EXISTING RIM JOIST OR BLOCKING WITH EXISTING NAILING TO BE VERIFIED PER SECTION A304.1.3
WHERE AN EXISTING RIM JOIST OR BLOCKING IS NOT PRESENT, PROVIDE NEW 2x SOLID BLOCKING AS FOLLOWS:
3-STORY: EVERY JOIST SPACE
2-STORY: EVERY JOIST SPACE ABOVE BRACED PANELS, ALTERNATE JOIST SPACES AT OTHER LOCATIONS
1-STORY: 2-2x OR 1-2x PLATE
EXISTING 2-2x OR 1-2x PLATE
EXISTING CRIPPLE STUD WALL SEE FIGURE A304.4.1(1) FOR BRACING
NEW 2x SOLID BLOCKING INSTALLED TO FIT TIGHTLY BETWEEN FLOOR JOISTS
NEW FRAMING CLIP (FLAT) AT EACH BLOCK TO PLATE WITH A MINIMUM HORIZONTAL CAPACITY OF 450 POUNDS. SPACE AS INDICATED ABOVE

ALTERNATE CONNECTION FOR FLUSH CONNECTION

For SI: 1 inch = 25.4 mm, 1 pound = 4.4 N.
NOTE: See manufacturing instructions for nail sizes associated with metal framing clips.

[BS] A304.1.4 Floor joists parallel to foundations. Where existing floor joists are parallel to the perimeter foundations, the end joist shall be located over the foundation and, except for required ventilation openings, shall be continuous and in continuous contact with the foundation sill plate or the top plate of the cripple wall. Existing connections at the top and bottom edges of the end joist need not be verified in one-story buildings. In multiple-story buildings, the existing top edge connection of the end joist need not be verified; however, the bottom edge connection to either the foundation sill plate or the top plate of a cripple wall shall be verified. The minimum bottom edge connection shall be 8d toenails spaced 6 inches (152 mm) apart. If this minimum bottom edge connection is not present or cannot be verified, a supplemental connection installed as shown in Figure A304.1.4(1), A304.1.4(2) or A304.1.4(3) shall be provided.

[BS] FIGURE A304.1.4(1)—TYPICAL FLOOR TO CRIPPLE WALL CONNECTION (FLOOR JOISTS PARALLEL TO FOUNDATIONS)

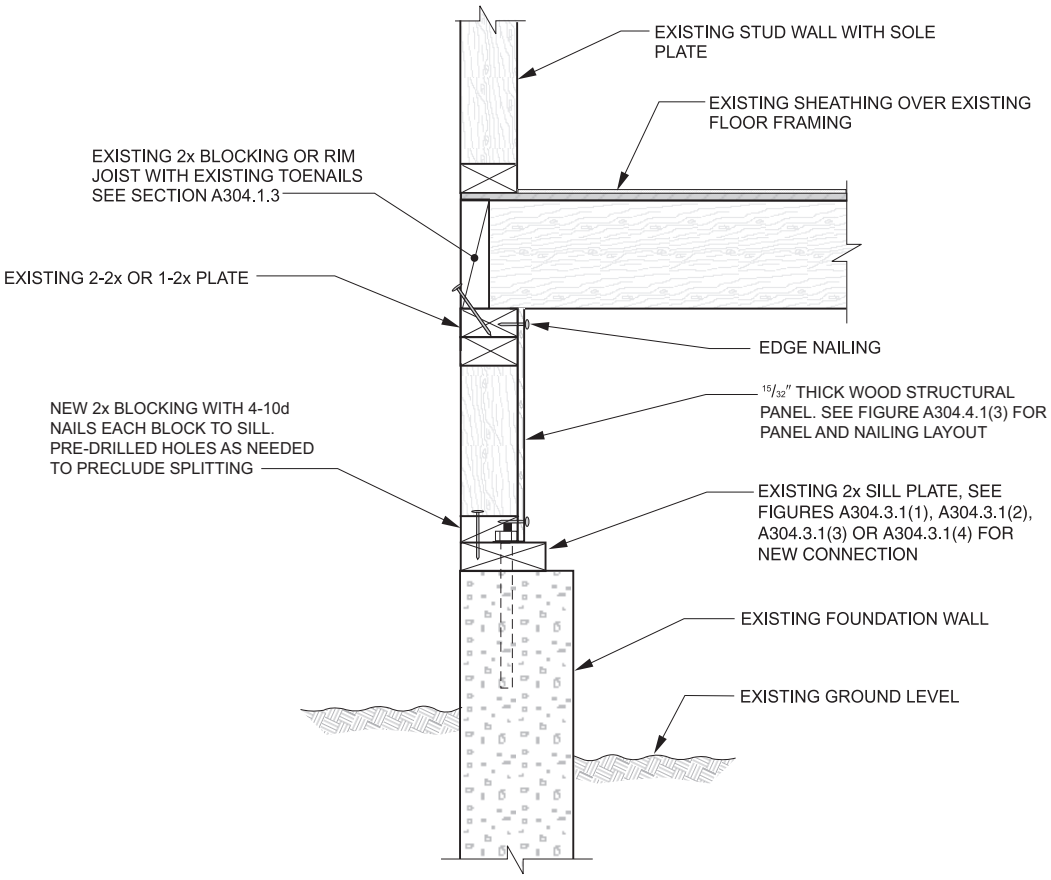

WHERE EXISTING NAILING CANNOT BE VERIFIED FROM THE EXISTING RIM JOIST TO TOP PLATE, PROVIDE A FRAMING CLIP WITH A MINIMUM HORIZONTAL CAPACITY OF 450 POUNDS AS FOLLOWS:
3-STORY: 16″ O.C.
2-STORY: 32″ O.C.
1-STORY: 48″ O.C.
EXISTING RIM JOIST
EXISTING NAILING TO BE VERIFIED PER SECTION A304.1.4
EXISTING 2-2x OR 1-2x PLATE
EXISTING CRIPPLE STUD WALL: SEE FIGURE A304.4.1(2) FOR BRACING
NEW 2x RIM JOIST INSTALLED TO FIT TIGHTLY BETWEEN FLOOR JOISTS
EXISTING RIM JOIST
FRAMING CLIP (FLAT) EACH AT THE SPACING INDICATED ABOVE WITH A HORIZONTAL CAPACITY OF 450 POUNDS

ALTERNATE CONNECTION FOR FLUSH CONNECTION

For SI: 1 inch = 25.4 mm, 1 pound = 4.4 N.

NOTE: See manufacturing instructions for nail sizes associated with metal framing clips.

[BS] FIGURE A304.1.4(2)—TYPICAL FLOOR TO MUDSILL CONNECTIONS

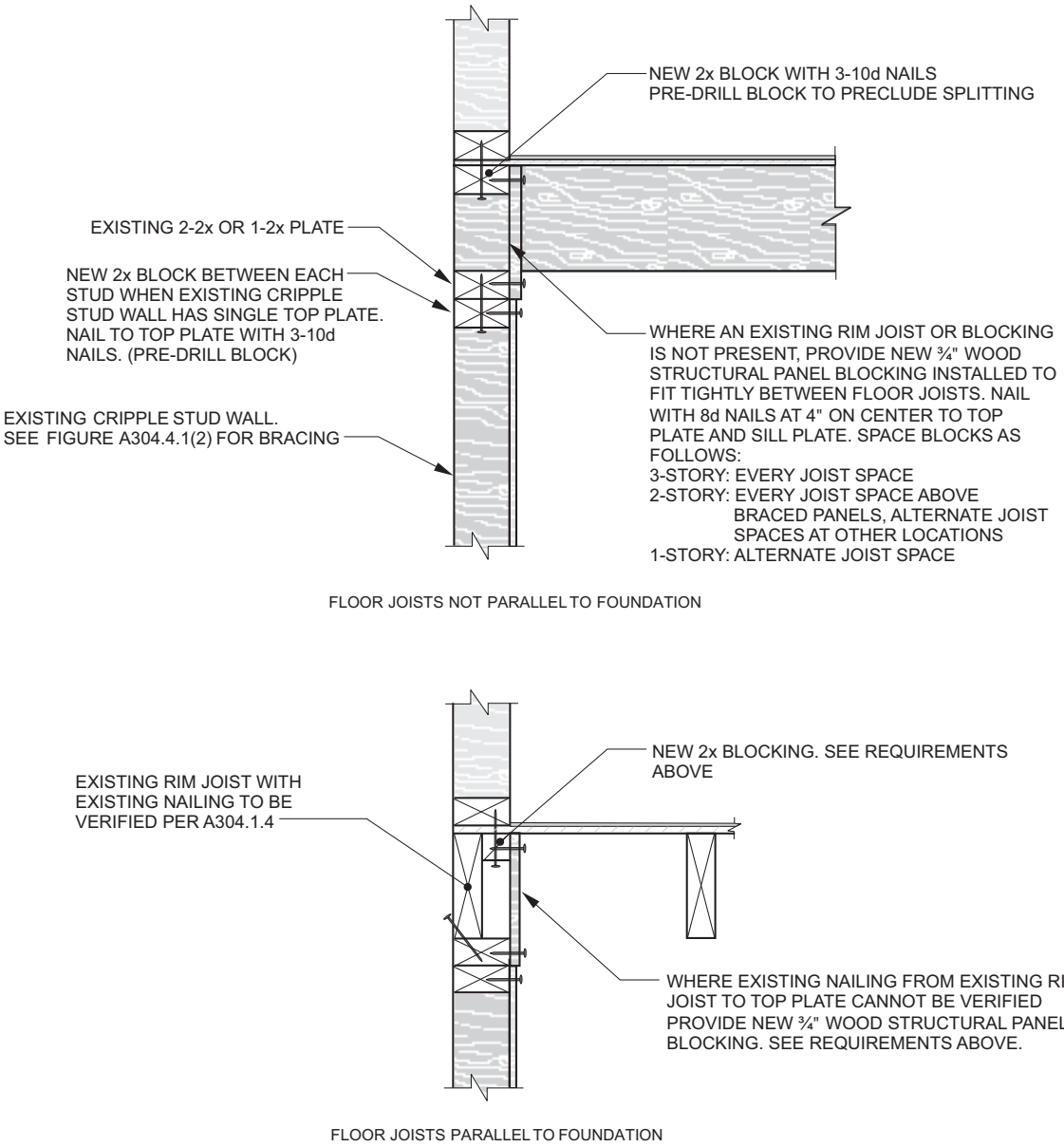

EXISTING STUD WALL WITH SOLE PLATE
EXISTING SHEATHING OVER EXISTING FLOOR FRAMING
EXISTING 2x BLOCKING OR RIM JOIST WITH EXISTING TOENAILS SEE SECTION A304.1.3
EXISTING 2-2x OR 1-2x PLATE
EDGE NAILING
15/32″ THICK WOOD STRUCTURAL PANEL. SEE FIGURE A304.4.1(3) FOR PANEL AND NAILING LAYOUT
NEW 2x BLOCKING WITH 4-10d NAILS EACH BLOCK TO SILL. PRE-DRILLED HOLES AS NEEDED TO PRECLUDE SPLITTING
EXISTING 2x SILL PLATE, SEE FIGURES A304.3.1(1), A304.3.1(2), A304.3.1(3) OR A304.3.1(4) FOR NEW CONNECTION
EXISTING FOUNDATION WALL
EXISTING GROUND LEVEL

For SI: 1 inch = 25.4 mm.

NOTES:

1. See Section A304.3 for sill plate anchorage.
2. See manufacturing instructions for nail sizes associated with metal framing clips.

[BS] FIGURE A304.1.4(3)—ALTERNATIVE FLOOR FRAMING TO CRIPPLE WALL CONNECTION


NEW 2x BLOCK WITH 3-10d NAILS
PRE-DRILL BLOCK TO PRECLUDE SPLITTING
EXISTING 2-2x OR 1-2x PLATE
NEW 2x BLOCK BETWEEN EACH STUD WHEN EXISTING CRIPPLE STUD WALL HAS SINGLE TOP PLATE. NAIL TO TOP PLATE WITH 3-10d NAILS. (PRE-DRILL BLOCK)
EXISTING CRIPPLE STUD WALL. SEE FIGURE A304.4.1(2) FOR BRACING
WHERE AN EXISTING RIM JOIST OR BLOCKING IS NOT PRESENT, PROVIDE NEW ¾" WOOD STRUCTURAL PANEL BLOCKING INSTALLED TO FIT TIGHTLY BETWEEN FLOOR JOISTS. NAIL WITH 8d NAILS AT 4" ON CENTER TO TOP PLATE AND SILL PLATE. SPACE BLOCKS AS FOLLOWS:
3-STORY: EVERY JOIST SPACE
2-STORY: EVERY JOIST SPACE ABOVE BRACED PANELS, ALTERNATE JOIST SPACES AT OTHER LOCATIONS
1-STORY: ALTERNATE JOIST SPACE
FLOOR JOISTS NOT PARALLEL TO FOUNDATION
NEW 2x BLOCKING. SEE REQUIREMENTS ABOVE
EXISTING RIM JOIST WITH EXISTING NAILING TO BE VERIFIED PER A304.1.4
WHERE EXISTING NAILING FROM EXISTING RIM JOIST TO TOP PLATE CANNOT BE VERIFIED PROVIDE NEW ¾" WOOD STRUCTURAL PANEL BLOCKING. SEE REQUIREMENTS ABOVE.
FLOOR JOISTS PARALLEL TO FOUNDATION

For SI: 1 inch = 25.4 mm, 1 pound = 4.4 N.
NOTE: See Section A304.4 for cripple wall bracing.

[BS] A304.2 Foundations.

[BS] A304.2.1 New perimeter foundations. New perimeter foundations shall be provided for structures with the structural weaknesses noted in Items 1 and 2 of Section A303. Soil investigations or geotechnical studies are not required for this work unless the building is located in a special study zone as designated by the *code official* or other authority having jurisdiction.

[BS] A304.2.2 Evaluation of existing foundations. Partial perimeter foundations or unreinforced masonry foundations shall be evaluated by a registered design professional for the force levels specified in Section A301.3. Test reports or other substantiating data to determine existing foundation material strengths shall be submitted to the *code official*. Where *approved* by the *code official*, these existing foundation systems shall be strengthened in accordance with the recommendations included with the evaluation in lieu of being replaced.

Exception: In lieu of testing existing foundations to determine material strengths, and where *approved* by the *code official*, a new nonperimeter foundation system designed for the forces specified in Section A301.3 shall be used to resist lateral forces from perimeter walls. A registered design professional shall confirm the ability of the existing diaphragm to transfer seismic forces to the new nonperimeter foundations.

[BS] A304.2.3 Details for new perimeter foundations. All new perimeter foundations shall be continuous and constructed according to Figure A304.2.3(1) and Table A304.2.3(1) or Figure A304.2.3(2) and Table A304.2.3(2). New construction materials

shall comply with the requirements of building code. Where *approved* by the *code official*, the existing clearance between existing floor joists or girders and existing grade below the floor need not comply with the building code.

Exception: Where designed by a registered design professional and *approved* by the *code official*, partial perimeter foundations shall be used in lieu of a continuous perimeter foundation.

[BS]TABLE A304.2.3(1)—NEW REINFORCED CONCRETE FOUNDATION SYSTEM

MINIMUM FOUNDATION DIMENSIONS						MINIMUM FOUNDATION REINFORCING	
						Vertical reinforcing	
Number of stories	W	F	D[a, b, c]	T	H	Single-pour wall and footing	Footing placed separate from wall
1	12 inches	6 inches	12 inches	6 inches	≤ 24 inches	#4 @ 48 inches on center	#4 @ 32 inches on center
2	15 inches	7 inches	18 inches	8 inches	≥ 36 inches	#4 @ 48 inches on center	#4 @ 32 inches on center
3	18 inches	8 inches	24 inches	10 inches	≥ 36 inches	#4 @ 48 inches on center	#4 @ 18 inches on center

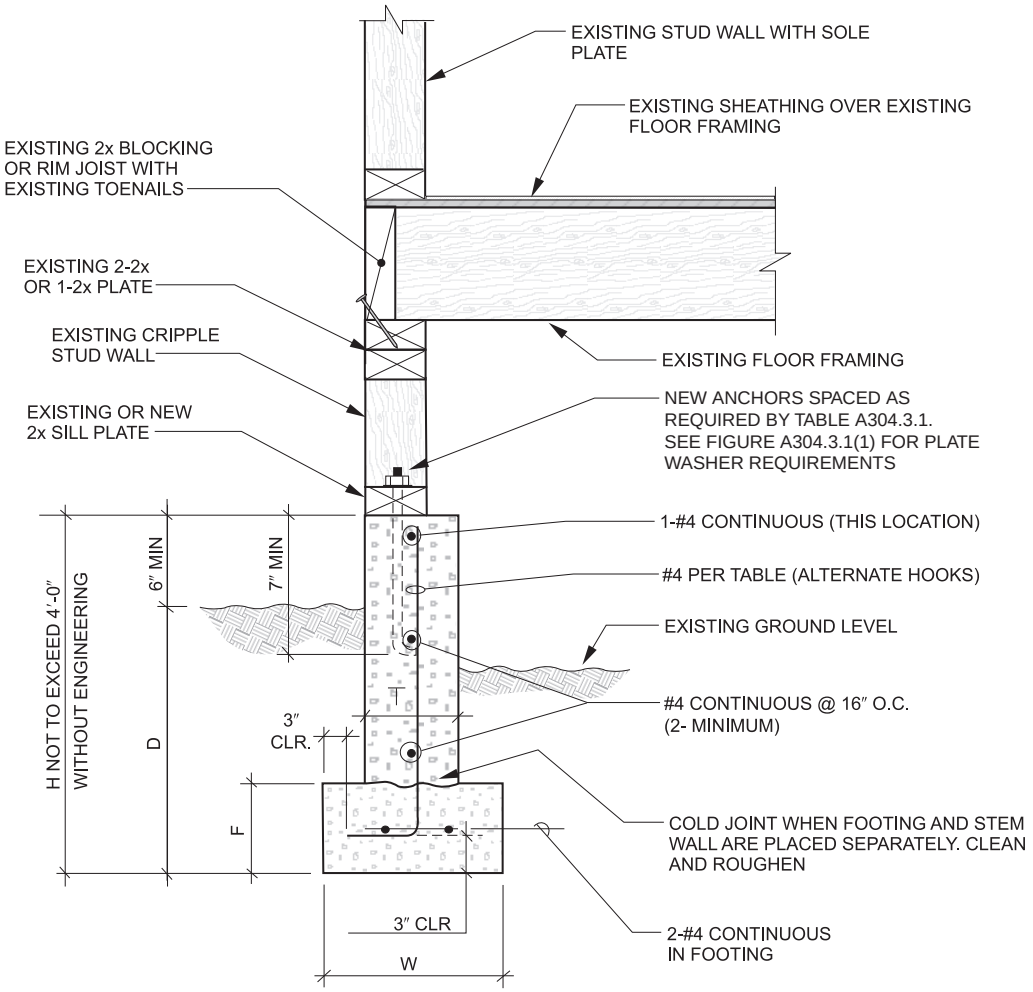
For SI: 1 inch = 25.4 mm.

a. Where frost conditions occur, the minimum depth shall extend below the frost line.

b. The ground surface along the interior side of the foundation may be excavated to the elevation of the top of the footing.

c. Where the soil is designated as expansive, the foundation depth and reinforcement shall be approved by the code official.

[BS] FIGURE A304.2.3(1)—NEW REINFORCED CONCRETE FOUNDATION SYSTEM


EXISTING STUD WALL WITH SOLE PLATE
EXISTING SHEATHING OVER EXISTING FLOOR FRAMING
EXISTING 2x BLOCKING OR RIM JOIST WITH EXISTING TOENAILS
EXISTING 2-2x OR 1-2x PLATE
EXISTING CRIPPLE STUD WALL
EXISTING FLOOR FRAMING
EXISTING OR NEW 2x SILL PLATE
NEW ANCHORS SPACED AS REQUIRED BY TABLE A304.3.1. SEE FIGURE A304.3.1(1) FOR PLATE WASHER REQUIREMENTS
1-#4 CONTINUOUS (THIS LOCATION)
#4 PER TABLE (ALTERNATE HOOKS)
EXISTING GROUND LEVEL
#4 CONTINUOUS @ 16″ O.C. (2- MINIMUM)
COLD JOINT WHEN FOOTING AND STEM WALL ARE PLACED SEPARATELY. CLEAN AND ROUGHEN
2-#4 CONTINUOUS IN FOOTING
H NOT TO EXCEED 4′-0″ WITHOUT ENGINEERING
6″ MIN
7″ MIN
D
T
3″ CLR.
F
3″ CLR
W

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

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[BS]TABLE A304.2.3(2)—NEW MASONRY CONCRETE FOUNDATION							
MINIMUM FOUNDATION DIMENSIONS						MINIMUM FOUNDATION REINFORCING	
Number of stories	W	F	D[a, b, c]	T	H	Vertical reinforcing	Horizontal reinforcing
1	12 inches	6 inches	12 inches	6 inches	≤ 24 inches	#4 @ 24 inches on center	#4 continuous at top of stem wall
2	15 inches	7 inches	18 inches	8 inches	≥ 24 inches	#4 @ 24 inches on center	#4 @ 16 inches on center
3	18 inches	8 inches	24 inches	10 inches	≥ 36 inches	#4 @ 24 inches on center	#4 @ 16 inches on center

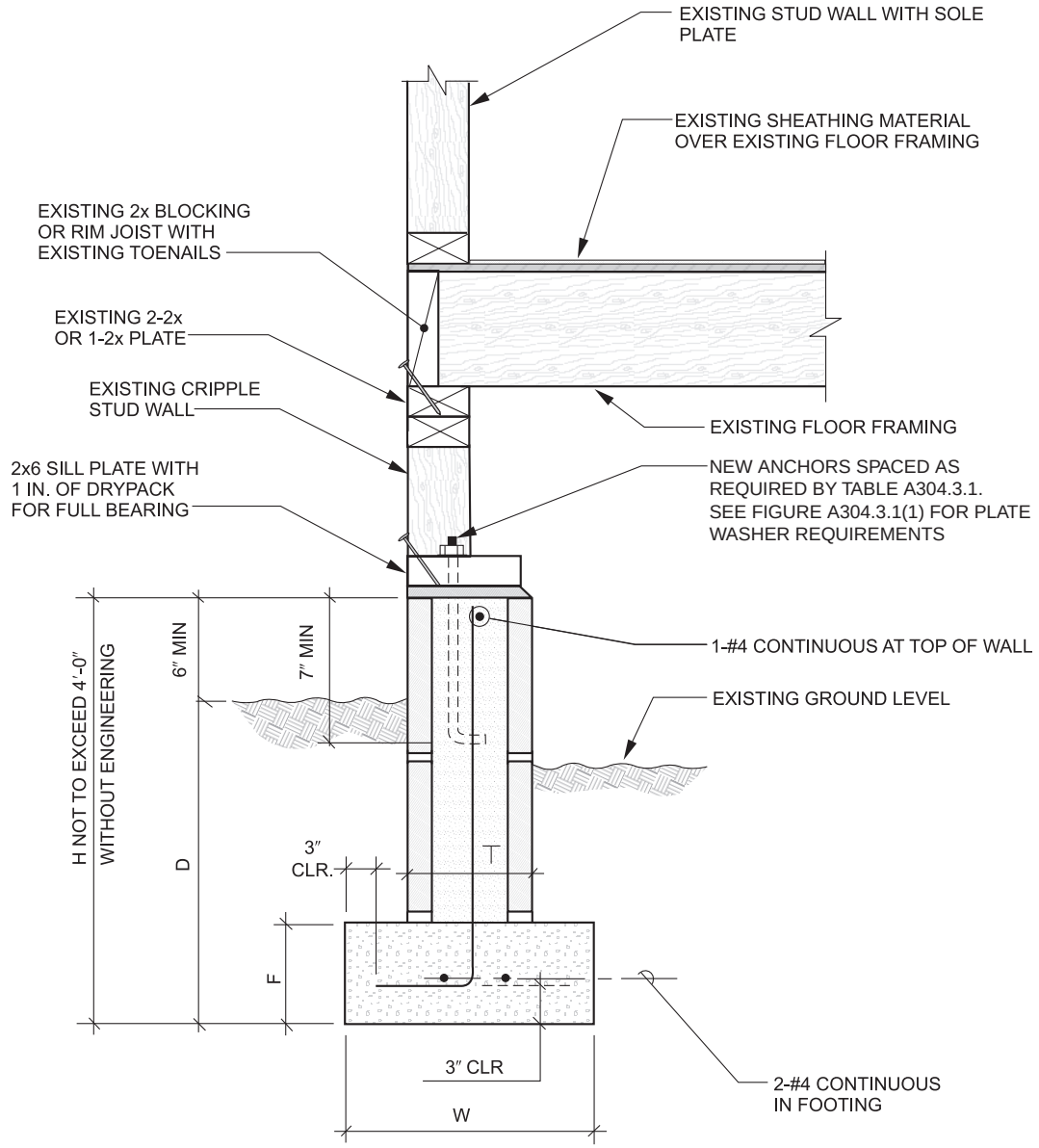
For SI: 1 inch = 25.4 mm.

a. Where frost conditions occur, the minimum depth shall extend below the frost line.

b. The ground surface along the interior side of the foundation may be excavated to the elevation of the top of the footing.

c. Where the soil is designated as expansive, the foundation depth and reinforcement shall be approved by the code official.

[BS] FIGURE A304.2.3(2)—NEW MASONRY CONCRETE FOUNDATION


EXISTING STUD WALL WITH SOLE PLATE
EXISTING SHEATHING MATERIAL OVER EXISTING FLOOR FRAMING
EXISTING 2x BLOCKING OR RIM JOIST WITH EXISTING TOENAILS
EXISTING 2-2x OR 1-2x PLATE
EXISTING CRIPPLE STUD WALL
EXISTING FLOOR FRAMING
2x6 SILL PLATE WITH 1 IN. OF DRYPACK FOR FULL BEARING
NEW ANCHORS SPACED AS REQUIRED BY TABLE A304.3.1. SEE FIGURE A304.3.1(1) FOR PLATE WASHER REQUIREMENTS
1-#4 CONTINUOUS AT TOP OF WALL
EXISTING GROUND LEVEL
H NOT TO EXCEED 4′-0″ WITHOUT ENGINEERING
6″ MIN
7″ MIN
D
3″ CLR.
F
3″ CLR
W
2-#4 CONTINUOUS IN FOOTING

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

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[BS] A304.2.4 New concrete foundations. New concrete foundations shall have a minimum compressive strength of 2,500 pounds per square inch (17.24 MPa) at 28 days.

[BS] A304.2.5 New hollow-unit masonry foundations. New hollow-unit masonry foundations shall be solidly grouted. The grout shall have minimum compressive strength of 2,000 pounds per square inch (13.79 MPa). Mortar shall be Type M or S.

[BS] A304.2.6 New sill plates. Where new sill plates are used in conjunction with new foundations, they shall be minimum two times nominal thickness and shall be preservative-treated wood or naturally durable wood permitted by the building code for similar applications, and shall be marked or branded by an *approved* agency. Fasteners in contact with preservative-treated wood shall be hot-dip galvanized or other material permitted by the building code for similar applications. Anchors, that attach a preservative-treated sill plate to the foundation, shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B695, Class 55 minimum. Metal framing anchors in contact with preservative-treated wood shall be galvanized in accordance with ASTM A653 with a G185 coating.

[BS] A304.3 Foundation sill plate anchorage.

[BS] A304.3.1 Existing perimeter foundations. Where the building has an existing continuous perimeter foundation, all perimeter wall sill plates shall be anchored to the foundation with adhesive anchors or expansion anchors in accordance with Table A304.3.1.

Anchors shall be installed in accordance with Figure A304.3.1(1), with the plate washer installed between the nut and the sill plate. The nut shall be tightened to a snugtight condition after curing is complete for adhesive anchors and after expansion wedge engagement for expansion anchors. Anchors shall be installed in accordance with manufacturer's recommendations. Expansion anchors shall not be used where the installation causes surface cracking of the foundation wall at the locations of the anchor.

Where existing conditions prevent anchor installations through the top of the sill plate, this connection shall be made in accordance with Figure A304.3.1(2), A304.3.1(3) or A304.3.1(4). Alternative anchorage methods having a minimum shear capacity of 900 pounds (4003 N) per connection parallel to the wall shall be permitted. The spacing of these alternative connections shall comply with the maximum spacing requirements of Table A304.3.1 for $^1/_2$-inch (12.7 mm) bolts.

[BS] TABLE A304.3.1—SILL PLATE ANCHORAGE AND CRIPPLE WALL BRACING

NUMBER OF STORIES ABOVE CRIPPLE WALLS	MINIMUM SILL PLATE CONNECTION AND MAXIMUM SPACING[a, b, c]	AMOUNT OF BRACING FOR EACH WALL LINE[d, e, f]	
		A combination of exterior walls finished with Portland cement plaster and roofing using clay tile or concrete tile weighing more than 6 psf (287 N/m^2)	All other conditions
One story	$^1/_2$ inch spaced 6 feet, 0 inch center-to-center with washer plate	Each end and not less than 50 percent of the wall length	Each end and not less than 40 percent of the wall length
Two stories	$^1/_2$ inch spaced 4 feet, 0 inch center-to-center with washer plate; or $^5/_8$ inch spaced 6 feet, 0 inch center-to-center with washer plate	Each end and not less than 70 percent of the wall length	Each end and not less than 50 percent of the wall length
Three stories	$^5/_8$ inch spaced 4 feet, 0 inch center-to-center with washer plate	100 percent of the wall length[g]	Each end and not less than 80 percent of the wall length[g]

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.88 N/m^2.

a. Sill plate anchors shall be adhesive anchors or expansion anchors in accordance with Section A304.3.1.
b. All washer plates shall be 3 inches by 3 inches by 0.229 inch minimum. The hole in the plate washer is permitted to be diagonally slotted with a width of up to $^3/_{16}$ inch larger than the bolt diameter and a slot length not to exceed $1^3/_4$ inches, provided that a standard cut washer is placed between the plate washer and the nut.
c. This table shall also be permitted for the spacing of the alternative connections specified in Section A304.3.1.
d. See Figure A304.4.2 for braced panel layout.
e. Braced panels at ends of walls shall be located as near to the end as possible.
f. All panels along a wall shall be nearly equal in length and shall be nearly equal in spacing along the length of the wall.
g. The minimum required underfloor ventilation openings are permitted in accordance with Section A304.4.4.

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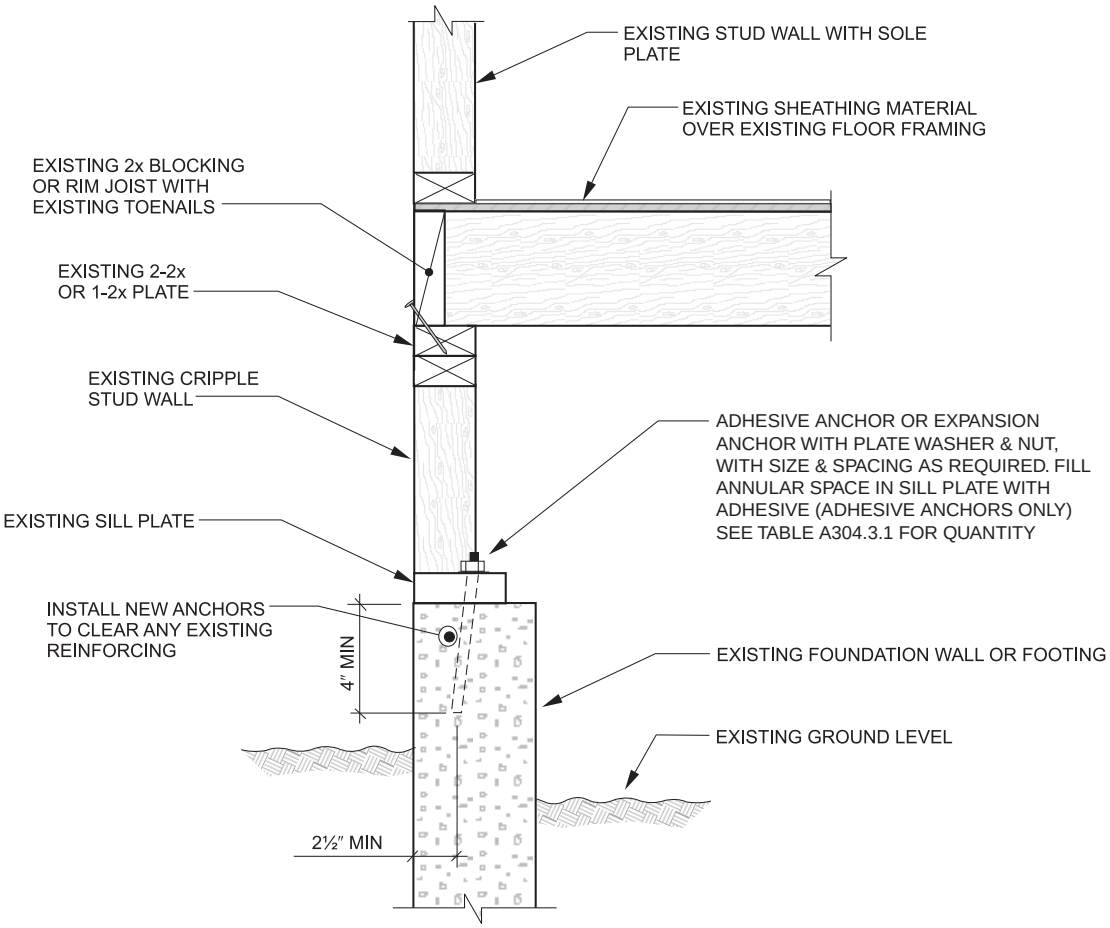
[BS] FIGURE A304.3.1(1)—SILL PLATE BOLTING TO EXISTING FOUNDATION[a, b]

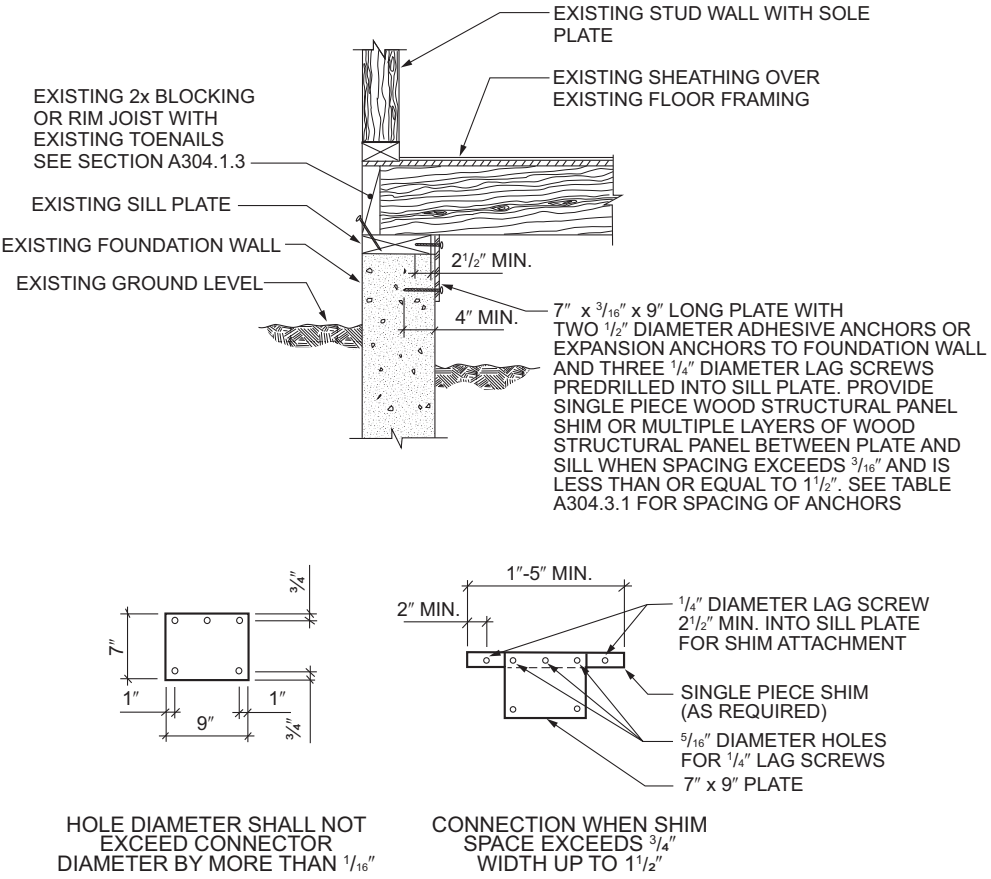

EXISTING STUD WALL WITH SOLE PLATE
EXISTING SHEATHING MATERIAL OVER EXISTING FLOOR FRAMING
EXISTING 2x BLOCKING OR RIM JOIST WITH EXISTING TOENAILS
EXISTING 2-2x OR 1-2x PLATE
EXISTING CRIPPLE STUD WALL
ADHESIVE ANCHOR OR EXPANSION ANCHOR WITH PLATE WASHER & NUT, WITH SIZE & SPACING AS REQUIRED. FILL ANNULAR SPACE IN SILL PLATE WITH ADHESIVE (ADHESIVE ANCHORS ONLY) SEE TABLE A304.3.1 FOR QUANTITY
EXISTING SILL PLATE
INSTALL NEW ANCHORS TO CLEAR ANY EXISTING REINFORCING
4" MIN
EXISTING FOUNDATION WALL OR FOOTING
EXISTING GROUND LEVEL
2½" MIN

For SI: 1 inch = 25.4 mm.

a. Plate washers shall comply with the following:
   $^{1}/_{2}$-inch anchor or bolt—3 inches × 3 inches × 0.229 inch minimum.
   $^{5}/_{8}$-inch anchor or bolt—3 inches × 3 inches × 0.229 inch minimum.
   A diagonal slot in the plate washer is permitted in accordance with Table A304.3.1, Note b.

b. See Figure A304.4.1(1) or A304.4.1(2) for cripple wall bracing.

[BS] FIGURE A304.3.1(2)—ALTERNATIVE SILL PLATE ANCHORING IN EXISTING FOUNDATION—WITHOUT CRIPPLE WALLS AND FLOOR FRAMING NOT PARALLEL TO FOUNDATIONS[a, b]

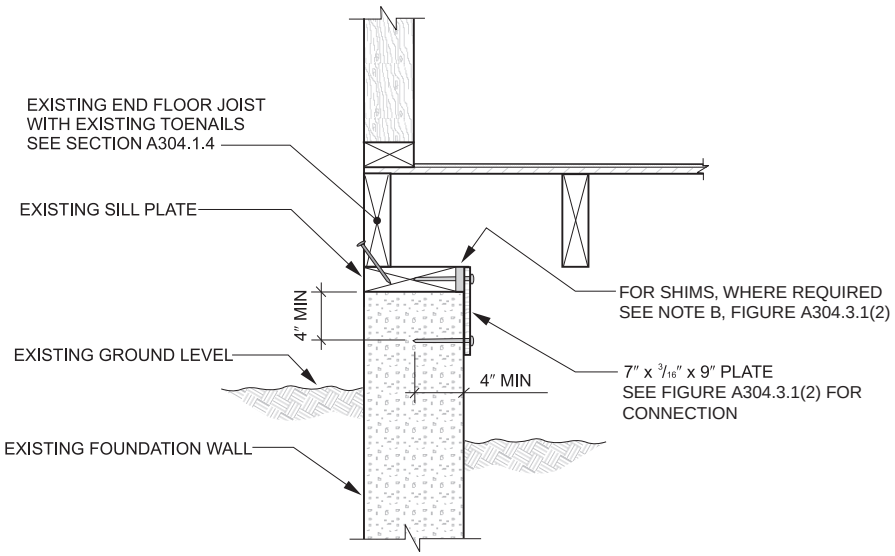

EXISTING STUD WALL WITH SOLE PLATE
EXISTING SHEATHING OVER EXISTING FLOOR FRAMING
EXISTING 2x BLOCKING OR RIM JOIST WITH EXISTING TOENAILS SEE SECTION A304.1.3
EXISTING SILL PLATE
EXISTING FOUNDATION WALL
EXISTING GROUND LEVEL
2 1/2″ MIN.
4″ MIN.
7″ x 3/16″ x 9″ LONG PLATE WITH TWO 1/2″ DIAMETER ADHESIVE ANCHORS OR EXPANSION ANCHORS TO FOUNDATION WALL AND THREE 1/4″ DIAMETER LAG SCREWS PREDRILLED INTO SILL PLATE. PROVIDE SINGLE PIECE WOOD STRUCTURAL PANEL SHIM OR MULTIPLE LAYERS OF WOOD STRUCTURAL PANEL BETWEEN PLATE AND SILL WHEN SPACING EXCEEDS 3/16″ AND IS LESS THAN OR EQUAL TO 1 1/2″. SEE TABLE A304.3.1 FOR SPACING OF ANCHORS
7″
3/4″
1″
9″
1″
3/4″
HOLE DIAMETER SHALL NOT EXCEED CONNECTOR DIAMETER BY MORE THAN 1/16″
1″-5″ MIN.
2″ MIN.
1/4″ DIAMETER LAG SCREW 2 1/2″ MIN. INTO SILL PLATE FOR SHIM ATTACHMENT
SINGLE PIECE SHIM (AS REQUIRED)
5/16″ DIAMETER HOLES FOR 1/4″ LAG SCREWS
7″ x 9″ PLATE
CONNECTION WHEN SHIM SPACE EXCEEDS 3/4″ WIDTH UP TO 1 1/2″

For SI: 1 inch = 25.4 mm.

a. If shim space exceeds $1^1/_2$ inches, alternative details will be required.

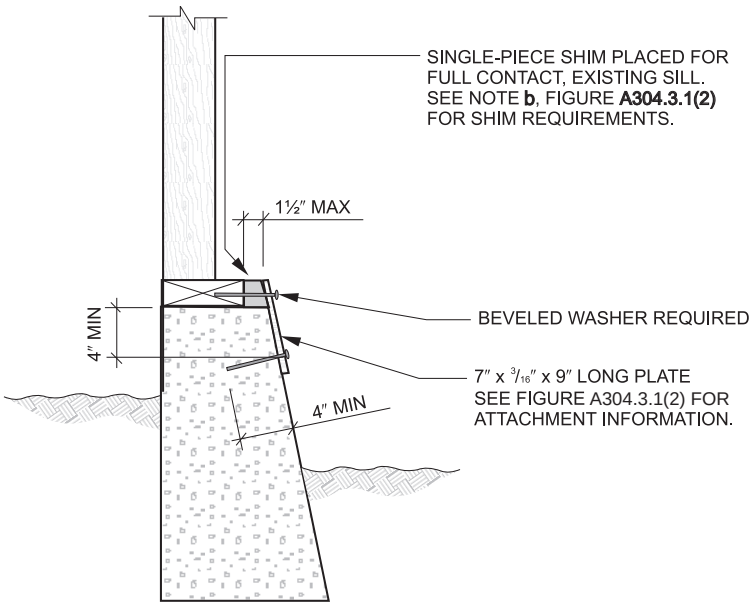
b. Where required, single piece shim shall be naturally durable wood or preservative-treated wood. If preservative-treated wood is used, it shall be isolated from the foundation system with a moisture barrier.

[BS] FIGURE A304.3.1(3)—ALTERNATIVE SILL PLATE ANCHOR TO EXISTING FOUNDATION WITHOUT CRIPPLE WALL AND FLOOR FRAMING PARALLEL TO FOUNDATIONS


EXISTING END FLOOR JOIST WITH EXISTING TOENAILS SEE SECTION A304.1.4
EXISTING SILL PLATE
4″ MIN
EXISTING GROUND LEVEL
EXISTING FOUNDATION WALL
FOR SHIMS, WHERE REQUIRED SEE NOTE B, FIGURE A304.3.1(2)
7″ x 3/16″ x 9″ PLATE SEE FIGURE A304.3.1(2) FOR CONNECTION
4″ MIN

For SI: 1 inch = 25.4 mm.

[BS] FIGURE A304.3.1(4)—SILL PLATE ANCHORING TO EXISTING FOUNDATION—ALTERNATIVE CONNECTION FOR BATTERED FOOTING


SINGLE-PIECE SHIM PLACED FOR FULL CONTACT, EXISTING SILL. SEE NOTE b, FIGURE A304.3.1(2) FOR SHIM REQUIREMENTS.
1½″ MAX
4″ MIN
BEVELED WASHER REQUIRED
7″ x 3/16″ x 9″ LONG PLATE SEE FIGURE A304.3.1(2) FOR ATTACHMENT INFORMATION.
4″ MIN

For SI: 1 inch = 25.4 mm.

[BS] A304.3.2 Placement of anchors. Anchors shall be placed within 12 inches (305 mm), but not less than 9 inches (229 mm), from the ends of sill plates and shall be placed in the center of the stud space closest to the required spacing. New sill plates may be installed in pieces where necessary because of existing conditions. For lengths of sill plates 12 feet (3658 mm) or greater, anchors shall be spaced along the sill plate as specified in Table A304.3.1. For other lengths of sill plate, anchor placement shall be in accordance with Table A304.3.2.

Exception: Where physical obstructions such as fireplaces, plumbing or heating ducts interfere with the placement of an anchor, the anchor shall be placed as close to the obstruction as possible, but not less than 9 inches (229 mm) from the end of the plate. Center-to-center spacing of the anchors shall be reduced as necessary to provide the minimum total number of anchors required based on the full length of the wall. Center-to-center spacing shall be not less than 12 inches (305 mm).

[BS] TABLE A304.3.2—SILL PLATE ANCHORAGE FOR VARIOUS LENGTHS OF SILL PLATE[a, b]

NUMBER OF STORIES	LENGTHS OF SILL PLATE		
	Less than 12 feet to 6 feet	Less than 6 feet to 30 inches	Less than 30 inches[c]
One story	Three connections	Two connections	One connection
Two stories	Four connections for 1/2-inch anchors or bolts or three connections for 5/8-inch anchors or bolts	Two connections	One connection
Three stories	Four connections	Two connections	One connection

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Connections shall be either adhesive anchors or expansion anchors.

b. See Section A304.3.2 for minimum end distances.

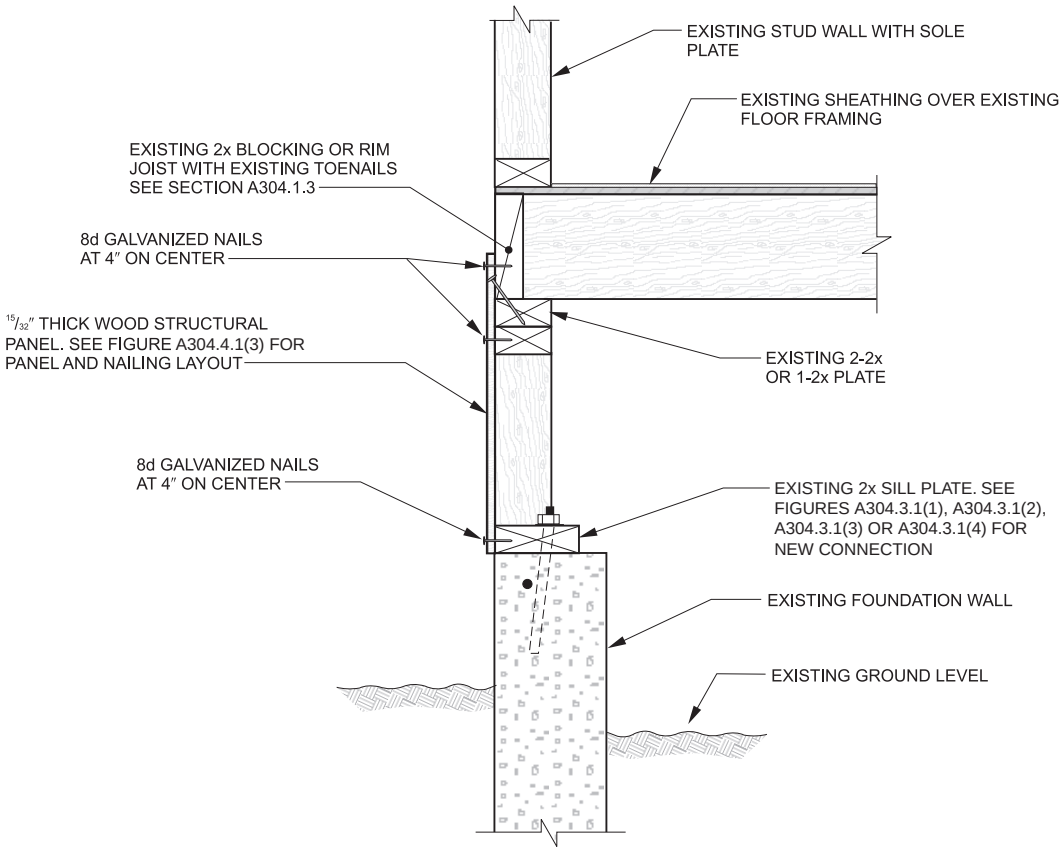
c. Connections shall be placed as near to the center of the length of plate as possible.

[BS] A304.3.3 New perimeter foundations. Sill plates for new perimeter foundations shall be anchored in accordance with Table A304.3.1 and Figure A304.2.3(1) and Table A304.2.3(1) or Figure A304.2.3(2) and Table A304.2.3(2).

[BS] A304.4 Cripple wall bracing.

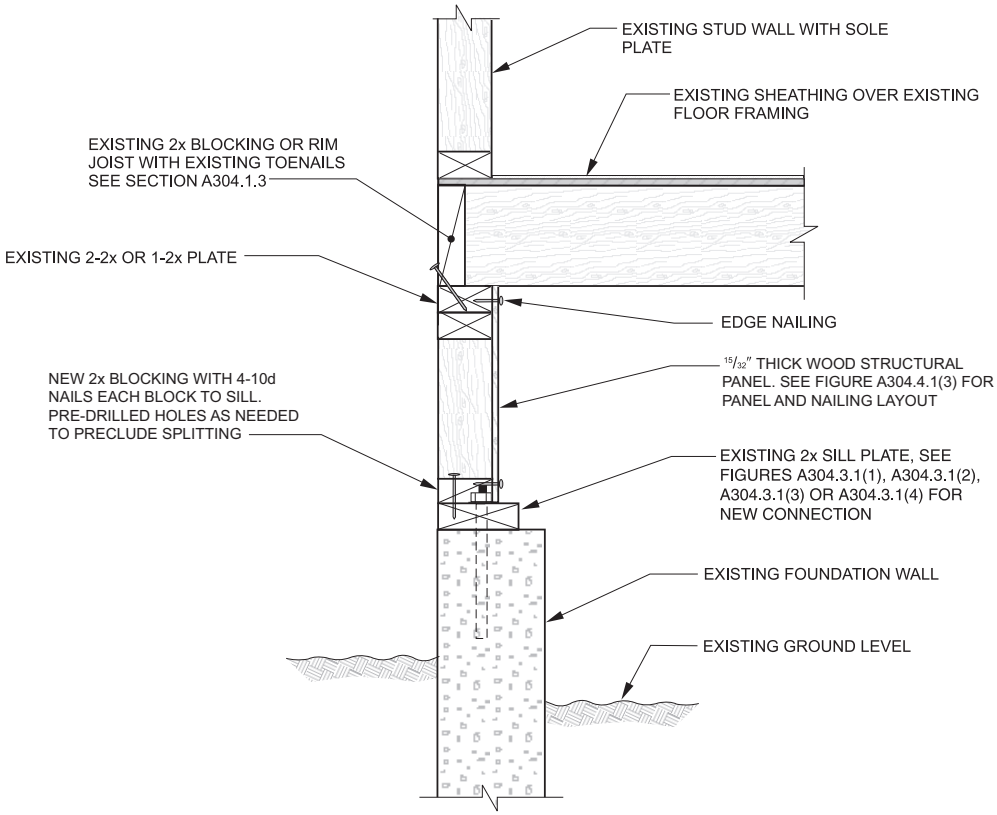
[BS] A304.4.1 General. Exterior cripple walls not exceeding 4 feet (1219 mm) in height shall be permitted to be specified by the prescriptive bracing method in Section A304.4. Cripple walls over 4 feet (1219 mm) in height require analysis by a registered design professional in accordance with Section A301.3.

[BS] FIGURE A304.4.1(1)—CRIPPLE WALL BRACING WITH NEW WOOD STRUCTURAL PANEL ON EXTERIOR FACE OF CRIPPLE STUDS


EXISTING STUD WALL WITH SOLE PLATE
EXISTING SHEATHING OVER EXISTING FLOOR FRAMING
EXISTING 2x BLOCKING OR RIM JOIST WITH EXISTING TOENAILS SEE SECTION A304.1.3
8d GALVANIZED NAILS AT 4″ ON CENTER
15/32″ THICK WOOD STRUCTURAL PANEL. SEE FIGURE A304.4.1(3) FOR PANEL AND NAILING LAYOUT
EXISTING 2-2x OR 1-2x PLATE
8d GALVANIZED NAILS AT 4″ ON CENTER
EXISTING 2x SILL PLATE. SEE FIGURES A304.3.1(1), A304.3.1(2), A304.3.1(3) OR A304.3.1(4) FOR NEW CONNECTION
EXISTING FOUNDATION WALL
EXISTING GROUND LEVEL

For SI: 1 inch = 25.4 mm.
NOTE: See Figure A304.3.1(1) for sill plate anchoring.

[BS] FIGURE A304.4.1(2)—CRIPPLE WALL BRACING WITH WOOD STRUCTURAL PANEL ON INTERIOR FACE OF CRIPPLE STUDS


EXISTING STUD WALL WITH SOLE PLATE
EXISTING SHEATHING OVER EXISTING FLOOR FRAMING
EXISTING 2x BLOCKING OR RIM JOIST WITH EXISTING TOENAILS SEE SECTION A304.1.3
EXISTING 2-2x OR 1-2x PLATE
EDGE NAILING
15/32″ THICK WOOD STRUCTURAL PANEL. SEE FIGURE A304.4.1(3) FOR PANEL AND NAILING LAYOUT
NEW 2x BLOCKING WITH 4-10d NAILS EACH BLOCK TO SILL. PRE-DRILLED HOLES AS NEEDED TO PRECLUDE SPLITTING
EXISTING 2x SILL PLATE, SEE FIGURES A304.3.1(1), A304.3.1(2), A304.3.1(3) OR A304.3.1(4) FOR NEW CONNECTION
EXISTING FOUNDATION WALL
EXISTING GROUND LEVEL

For SI: 1 inch = 25.4 mm.

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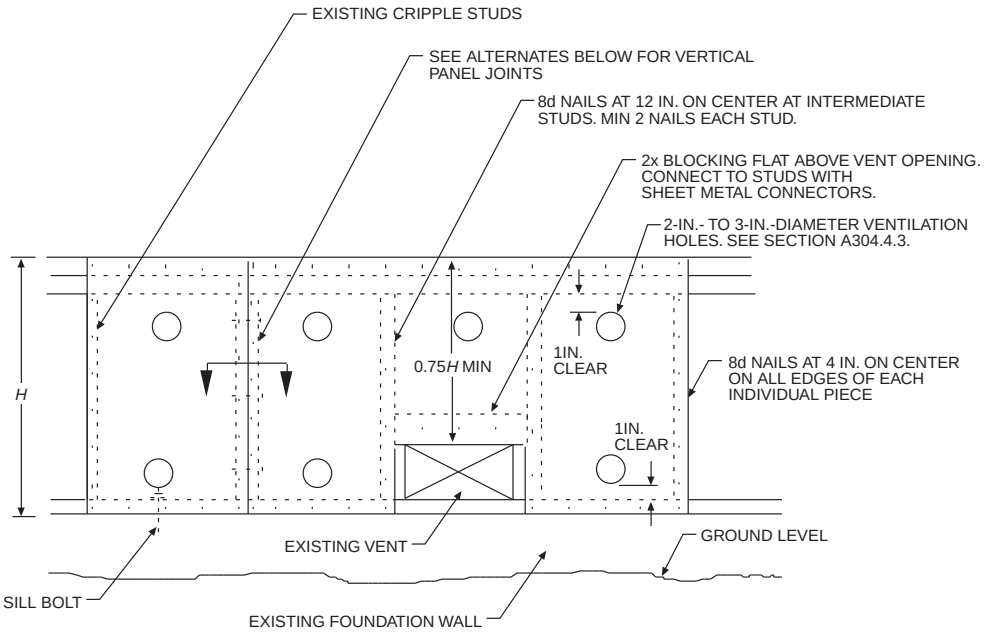
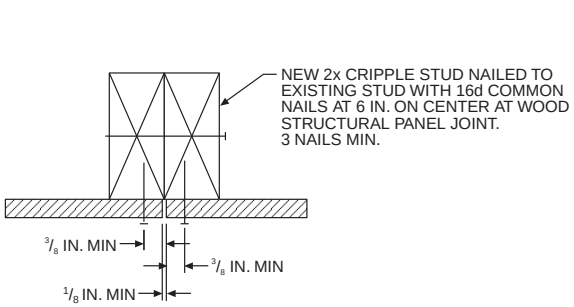
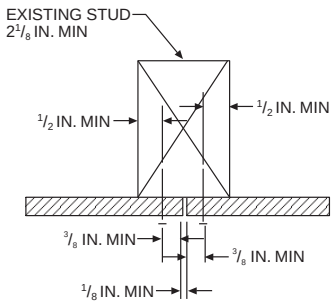
FIGURE A304.4.1(3) [BS] FIGURE A304.4.1(3)—PARTIAL CRIPPLE STUD WALL ELEVATION


EXISTING CRIPPLE STUDS
SEE ALTERNATES BELOW FOR VERTICAL PANEL JOINTS
8d NAILS AT 12 IN. ON CENTER AT INTERMEDIATE STUDS. MIN 2 NAILS EACH STUD.
2x BLOCKING FLAT ABOVE VENT OPENING. CONNECT TO STUDS WITH SHEET METAL CONNECTORS.
2-IN.- TO 3-IN.-DIAMETER VENTILATION HOLES. SEE SECTION A304.4.3.
H
0.75H MIN
1IN. CLEAR
8d NAILS AT 4 IN. ON CENTER ON ALL EDGES OF EACH INDIVIDUAL PIECE
1IN. CLEAR
EXISTING VENT
GROUND LEVEL
SILL BOLT
EXISTING FOUNDATION WALL


NEW 2x CRIPPLE STUD NAILED TO EXISTING STUD WITH 16d COMMON NAILS AT 6 IN. ON CENTER AT WOOD STRUCTURAL PANEL JOINT. 3 NAILS MIN.
3/8 IN. MIN
3/8 IN. MIN
1/8 IN. MIN

VERTICAL SPLICE AT DOUBLE STUD



VERTICAL SPLICE AT SINGLE STUD

For SI: 1 inch = 25.4 mm.

[BS] A304.4.1.1 Sheathing installation requirements. Wood structural panel sheathing shall be not less than $^{15}/_{32}$-inch (12 mm) thick and shall be installed in accordance with Figure A304.4.1(1) or A304.4.1(2). Individual pieces of wood structural panels shall be nailed with 8d common nails spaced 4 inches (102 mm) on center at all edges and 12 inches (305 mm) on center at each intermediate support with not less than two nails for each stud. Nails shall be driven so that their heads are flush with the surface of the sheathing and shall penetrate the supporting member not less than $1^{1}/_{2}$ inches (38 mm). When a nail fractures the surface, it shall be left in place and not counted as part of the required nailing. A new 8d nail shall be located within 2 inches (51 mm) of the discounted nail and be hand-driven flush with the sheathing surface. Where the installation involves horizontal joints, those joints shall occur over nominal 2-inch by 4-inch (51 mm by 102 mm) blocking installed with the nominal 4-inch (102 mm) dimension against the face of the plywood.

Vertical joints at adjoining pieces of wood structural panels shall be centered on studs such that there is a minimum $^{1}/_{8}$ inch (3.2 mm) between the panels. Where required edge distances cannot be maintained because of the width of the existing stud, a new stud shall be added adjacent to the existing studs and connected in accordance with Figure A304.4.1(3).

[BS] A304.4.2 Distribution and amount of bracing. See Table A304.3.1 and Figure A304.4.2 for the distribution and amount of bracing required for each wall line. Each braced panel length must be not less than two times the height of the cripple stud. Where the minimum amount of bracing prescribed in Table A304.3.1 cannot be installed along any walls, the bracing must be designed in accordance with Section A301.3.

Exception: Where physical obstructions such as fireplaces, plumbing or heating ducts interfere with the placement of cripple wall bracing, the bracing shall then be placed as close to the obstruction as possible. The total amount of bracing required shall not be reduced because of obstructions.

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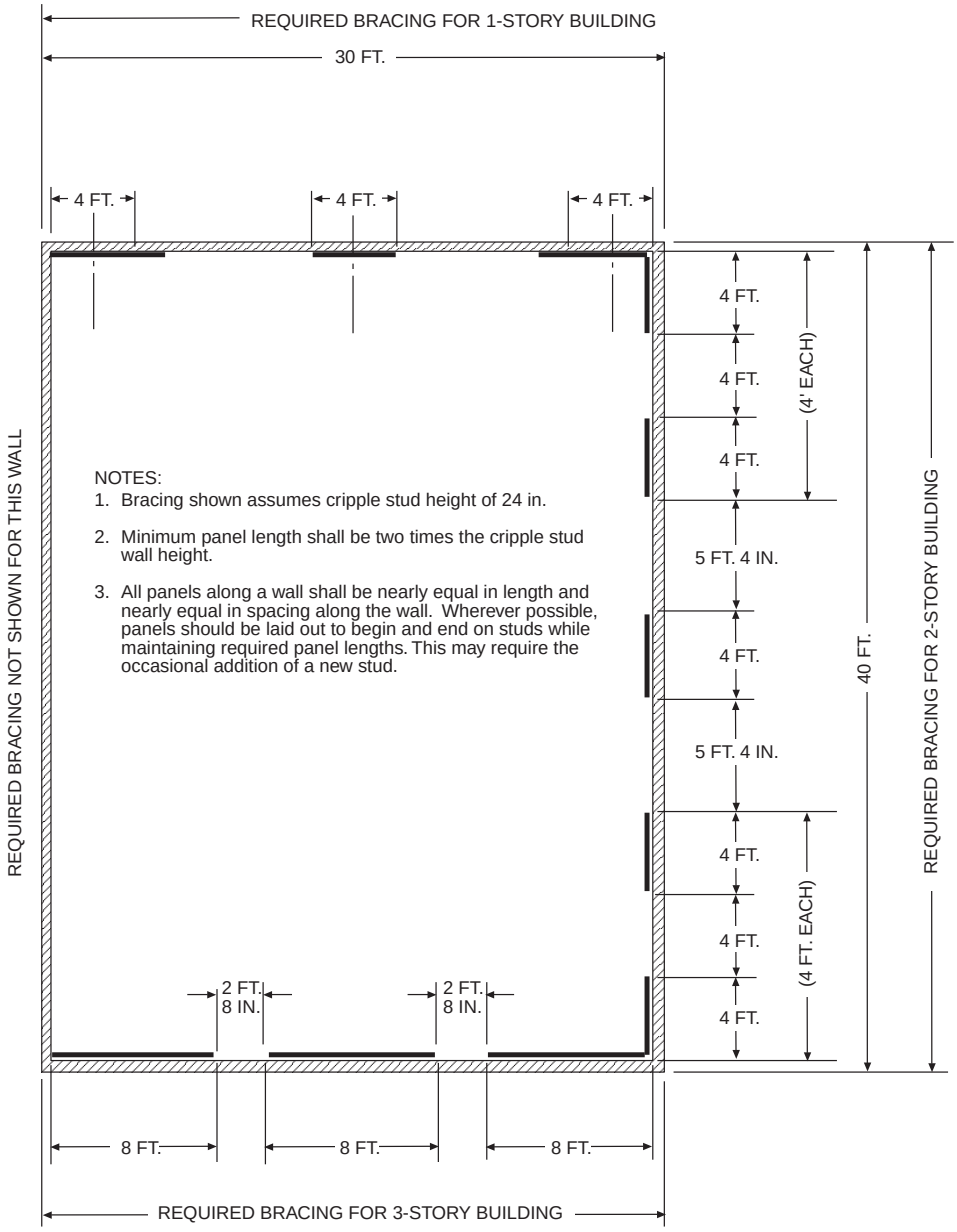
[BS] FIGURE A304.4.2—FLOOR PLAN-CRIPPLE WALL BRACING LAYOUT


REQUIRED BRACING FOR 1-STORY BUILDING
30 FT.
4 FT.
4 FT.
4 FT.
4 FT.
4 FT.
4 FT.
(4' EACH)
4 FT.
5 FT. 4 IN.
4 FT.
5 FT. 4 IN.
4 FT.
4 FT.
4 FT.
(4 FT. EACH)
4 FT.
40 FT.
REQUIRED BRACING FOR 2-STORY BUILDING
REQUIRED BRACING NOT SHOWN FOR THIS WALL
NOTES:
1. Bracing shown assumes cripple stud height of 24 in.
2. Minimum panel length shall be two times the cripple stud wall height.
3. All panels along a wall shall be nearly equal in length and nearly equal in spacing along the wall. Wherever possible, panels should be laid out to begin and end on studs while maintaining required panel lengths. This may require the occasional addition of a new stud.
2 FT. 8 IN.
2 FT. 8 IN.
8 FT.
8 FT.
8 FT.
REQUIRED BRACING FOR 3-STORY BUILDING

Bracing determination:
1-story building—each end and not less than 40% of wall length.[a]
Transverse wall—30 ft. × 0.40 = 12 ft. minimum panel length = 4 ft. 0 in.
2-story building—each end and not less than 50% of wall length.[a]
Longitudinal wall—40 ft. × 0.50 = 20 ft. 0 in. minimum of bracing.
3-story building—each end and not less than 80% of wall length.[a]
Transverse wall —30 ft. × 0.80 = 24 ft. 0 in. minimum of bracing.
a. See Table 304.3.1 for buildings with both plaster walls and roofing exceeding 6 psf.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 42.88 N/m^2.

[BS] A304.4.3 Stud space ventilation. Where bracing materials are installed on the interior face of studs forming an enclosed space between the new bracing and the existing exterior finish, each braced stud space must be ventilated. Adequate ventilation and access for future inspection shall be provided by drilling one 2-inch to 3-inch-diameter (51 mm to 76 mm) round hole through the sheathing, nearly centered between each stud at the top and bottom of the cripple wall. Such holes should be spaced not less than 1 inch (25 mm) clear from the sill or top plates. In stud spaces containing sill bolts, the hole shall be located on the centerline of the sill bolt but not closer than 1 inch (25 mm) clear from the nailing edge of the sheathing. Where existing blocking occurs within the stud space, additional ventilation holes shall be placed above and below the blocking, or the existing block shall be removed and a new nominal 2-inch by 4-inch (51 mm by 102 mm) block shall be installed with the nominal 4-inch (102 mm) dimension against the face of the plywood. For stud heights less than 18 inches (457 mm), only one ventilation hole need be provided.

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[BS] A304.4.4 Existing underfloor ventilation. Existing underfloor ventilation shall not be reduced without providing equivalent new ventilation as close to the existing ventilation as possible. Braced panels may include underfloor ventilation openings where the height of the opening, measured from the top of the foundation wall to the top of the opening, does not exceed 25 percent of the height of the cripple stud wall; however, the length of the panel shall be increased a distance equal to the length of the opening or one stud space minimum. Where an opening exceeds 25 percent of the cripple wall height, braced panels shall not be located where the opening occurs. See Figure A304.4.1(3).

Exception: For homes with a post and pier foundation system where a new continuous perimeter foundation system is being installed, new ventilation shall be provided in accordance with the building code.

[BS] A304.5 Quality control. All work shall be subject to inspection by the *code official* including, but not limited to:

1. Placement and installation of new adhesive or expansion anchors installed in existing foundations. Special inspection is not required for adhesive anchors installed in existing foundations regulated by the prescriptive provisions of this chapter.
2. Installation and nailing of new cripple wall bracing.
3. Any work shall be subject to special inspection where required by the *code official* in accordance with the building code.

[BS] A304.5.1 Nails. All nails specified in this chapter shall be common wire nails of the following diameters and lengths:

1. 8d nails = 0.131 inch (3.3 mm) by $2^1/_2$ inches (64 mm).
2. 10d nails = 0.148 inch (3.8 mm) by 3 inches (76 mm).
3. 12d nails = 0.148 inch (3.8 mm) by $3^1/_4$ inches (83 mm).
4. 16d nails = 0.162 inch (4.1 mm) by $3^1/_2$ inches (89 mm).

Nails used to attach metal framing connectors directly to wood members shall be as specified by the connector manufacturer in an *approved* report.

CHAPTER A4
EARTHQUAKE RISK REDUCTION IN WOOD-FRAME RESIDENTIAL BUILDINGS WITH SOFT, WEAK OR OPEN FRONT WALLS

SECTION A401—GENERAL

[BS] A401.1 Purpose. The purpose of this chapter is to promote public welfare and safety by reducing the risk of death or injury as a result of the effects of earthquakes on existing wood-frame, multiple-unit residential buildings. The ground motions of past earthquakes have caused the loss of human life, personal injury and property damage in these types of buildings. This chapter creates minimum standards to strengthen the more vulnerable portions of these structures. Where fully followed, these minimum standards will improve the performance of these buildings but will not necessarily prevent all earthquake-related damage.

[BS] A401.2 Scope. The provisions of this chapter apply to *existing buildings* of wood construction that contain residential occupancies and are assigned to *Risk Category* II, and where the structure has a soft, weak or open-front wall line, and there exists one or more stories above**.**

SECTION A402—DEFINITIONS

[BS] A402.1 Definitions. Notwithstanding the applicable definitions, symbols and notations in the building code, the following definitions shall apply for the purposes of this chapter:

[BS] ASPECT RATIO. The span-width ratio for horizontal diaphragms and the height-length ratio for shear walls.

[BS] NONCONFORMING STRUCTURAL MATERIALS. Wall bracing materials other than wood structural panels or diagonal sheathing.

[BS] OPEN-FRONT WALL LINE. An exterior wall line, without vertical elements of the lateral force-resisting system, that requires tributary seismic forces to be resisted by diaphragm rotation or excessive cantilever beyond parallel lines of shear walls. Diaphragms that cantilever more than 25 percent of the distance between lines of lateral force-resisting elements from which the diaphragm cantilevers shall be considered to be excessive. Exterior exit balconies of 6 feet (1829 mm) or less in width shall not be considered excessive cantilevers.

[BS] RETROFIT. An improvement of the lateral force-resisting system by alteration of existing structural elements or *addition* of new structural elements.

[BS] SOFT WALL LINE. A wall line whose lateral stiffness is less than that required by story drift limitations or deformation compatibility requirements of this chapter. In lieu of analysis, a soft wall line may be defined as a wall line in a story where the story stiffness is less than 70 percent of the story above for the direction under consideration.

[BS] STORY. A story as defined by the building code, including any basement or underfloor space of a building with cripple walls exceeding 4 feet (1219 mm) in height.

[BS] WALL LINE. Any length of wall along a principal axis of the building used to provide resistance to lateral loads. Parallel wall lines separated by less than 4 feet (1219 mm) shall be considered to be one wall line for the distribution of loads.

[BS] WEAK WALL LINE. A wall line in a story where the story strength is less than 80 percent of the story above in the direction under consideration.

SECTION A403—ANALYSIS AND DESIGN

[BS] A403.1 General. Modifications required by the provisions in this chapter shall be designed in accordance with the *Building Code of New York State* provisions for new construction, except as modified by this chapter.

Exception: Buildings for which the prescriptive measures provided in Section A404 apply and are used.

Alteration of the existing lateral force-resisting system or vertical load-carrying system shall not reduce the strength or stiffness of the *existing structure*, unless the altered structure would remain in conformance to the building code and this chapter.

[BS] A403.2 Scope of analysis. This chapter requires the *alteration, repair*, replacement or addition of structural elements and their connections to meet the strength and stiffness requirements herein. The lateral load-path analysis shall include the resisting elements and connections from the wood diaphragm immediately above any soft, weak or open-front wall lines to the foundation soil interface or to the uppermost story of a podium structure comprised of steel, masonry, or concrete structural systems that supports the upper wood-framed structure. Stories above the uppermost story with a soft, weak or open-front wall line shall be considered in the analysis but need not be modified. The lateral load-path analysis for added structural elements shall include evaluation of the allowable soil-bearing and lateral pressures in accordance with the building code. Where any portion of a building within the scope of this chapter is constructed on or into a slope steeper than one unit vertical in three units horizontal (33-percent slope), the lateral force-resisting system at and below the base level diaphragm shall be analyzed for the effects of concentrated lateral forces at the base caused by this hillside condition.

[BS] A403.3 Design base shear and design parameters. The design base shear in a given direction shall be permitted to be 75 percent of the value required for similar new construction in accordance with the building code. The value of R used in the design of the strengthening of any story shall not exceed the lowest value of R used in the same direction at any story above. The system overstrength factor, Ω_0, and the deflection amplification factor, C_d, shall be not less than the largest respective value corresponding to the R factor being used in the direction under consideration.

Exceptions:

1. For structures assigned to Seismic Design Category B, values of R, Ω_0 and C_d shall be permitted to be based on the seismic force-resisting system being used to achieve the required strengthening.
2. For structures assigned to Seismic Design Category C or D, values of R, Ω_0 and C_d shall be permitted to be based on the seismic force-resisting system being used to achieve the required strengthening, provided that when the strengthening is complete, the strengthened structure will not have an extreme weak story irregularity defined as Type 5b in ASCE 7, Table 12.3-2.
3. For structures assigned to Seismic Design Category E, values of R, Ω_0 and C_d shall be permitted to be based on the seismic force-resisting system being used to achieve the required strengthening, provided that when the strengthening is complete, the strengthened structure will not have an extreme soft story, a weak story, or an extreme weak story irregularity defined, respectively, as Types 1b, 5a and 5b in ASCE 7, Table 12.3-2.
4. For retrofit systems involving different seismic force-resisting systems in the same direction within the same story, resisting elements are permitted to be designed using the least value of R for the different structural systems found in each independent line of resistance if all of the following conditions are met:
   - 4.1. The building is assigned to *Risk Category* I or II.
   - 4.2. The building height is no more than four stories above grade plane.
   - 4.3. The seismic force-resisting systems of the retrofitted building comprise only wood structural panel shear walls, steel moment-resisting frames, steel cantilever columns and steel-braced frames. Values for C and Ω_0 shall be consistent with the R value used.
5. With reference to ASCE 7, Table 12.2-1, ordinary, intermediate and special steel systems, and all light-frame systems shall be permitted without limitation where those systems are used only for retrofit to comply with the requirements of this chapter.

[BS] A403.3.1 Expected story strength. Despite any other requirement of Section A403.3 or A403.4, the total expected strength of retrofit elements added to any story need not exceed 1.7 times the expected strength of the story immediately above in a two-story building, or 1.3 times the expected strength of the story immediately above in a three-story or taller building, as long as the retrofit elements are located symmetrically about the center of mass of the story above, or so as to minimize torsion in the retrofitted story. Calculation of expected story strength and identification of irregularities in Section A403.3 shall be based on the expected strength of all wall lines, even if sheathed with nonconforming materials. The strength of a wall line above the retrofitted story shall be permitted to be reduced to account for inadequate load path or overturning resistance.

[BS] A403.3.2 Seismicity parameters, site class and geologic hazards. For any site designated as Site Class E, the value of F shall be taken as 1.2. Site-specific procedures are not required for compliance with this chapter. Mitigation of existing geologic site hazards such as liquefiable soil, fault rupture or landslide is not required for compliance with this chapter.

[BS] A403.4 Story drift limitations. The calculated story drift for each retrofitted story shall not exceed the allowable deformation compatible with all vertical load-resisting elements and 0.025 times the story height. The calculated story drift shall not be reduced by the effects of horizontal diaphragm stiffness but shall be increased where these effects produce rotation. Drift calculations shall be in accordance with the building code.

[BS] A403.4.1 Pole structures. The effects of rotation and soil stiffness shall be included in the calculated story drift where lateral loads are resisted by vertical elements whose required depth of embedment is determined by pole formulas. The coeffi-

cient of subgrade reaction used in deflection calculations shall be based on a geotechnical investigation conducted in accordance with the building code.

[BS] A403.5 Deformation compatibility and P Δ effects. The requirements of the building code shall apply, except as modified herein. Structural framing elements and their connections not required by design to be part of the lateral force-resisting system shall be designed and detailed to be adequate to maintain support of expected gravity loads when subjected to the expected deformations caused by seismic forces. Increased demand caused by P Δ effects and story sidesway stability shall be considered in retrofit stories that rely on the strength and stiffness of cantilever columns for lateral resistance.

[BS] A403.6 Ties and continuity. All parts of the structure included in the scope of Section A403.2 shall be interconnected as required by the building code.

[BS] A403.7 Collector elements. Collector elements shall be provided to transfer the seismic forces between the elements within the scope of Section A403.2.

[BS] A403.8 Floor diaphragms. Floor diaphragms within the scope of Section A403.2 shall be shown to have adequate strength at the following locations:

1. For straight lumber sheathed diaphragms without integral hardwood flooring throughout the diaphragm: The *code official* is authorized to waive the requirement where it is shown that the condition occurs in areas small enough not to affect overall building performance.
2. For all other diaphragms adequate strength shall be shown to be provided at locations where forces are transferred between the diaphragm and each new or strengthened vertical element of the seismic force-resisting system. Collector elements shall be provided where needed to distribute the transferred force over a greater length of diaphragm.

Exception: Where the existing vertical elements of the seismic force-resisting system are shown to comply with this chapter, diaphragms need not be evaluated.

[BS] A403.9 Wood-framed shear walls. Wood-framed shear walls shall have strength and stiffness sufficient to resist the seismic loads and shall conform to the requirements of this section. Where new sheathing is applied to existing studs to create new wood-framed shear walls, the new wall elements shall be considered bearing wall systems for purposes of determining seismic design parameters.

[BS] A403.9.1 Gypsum or cement plaster products. Gypsum or cement plaster products shall not be used to provide the strength required by Section A403.3 or the stiffness required by Section A403.4.

[BS] A403.9.2 Wood structural panels.

[BS] A403.9.2.1 Drift limit. Wood structural panel shear walls shall meet the story drift limitation of Section A403.4. Conformance to the story drift limitation shall be determined by *approved* testing or calculation. Individual shear panels shall be permitted to exceed the maximum aspect ratio, provided that the allowable story drift and allowable shear capacities are not exceeded.

[BS] A403.9.2.2 Openings. Shear walls are permitted to be designed for continuity around openings in accordance with the building code. Blocking and steel strapping shall be provided at corners of the openings to transfer forces from discontinuous boundary elements into adjoining panel elements. Alternatively, perforated shear wall provisions of the building code are permitted to be used.

[BS] A403.9.3 Hold-down connectors.

[BS] A403.9.3.1 Expansion anchors in tension. Expansion anchors that provide tension strength by friction resistance shall not be used to connect hold-down devices to existing concrete or masonry elements.

[BS] A403.9.3.2 Required depth of embedment. The required depth of embedment or edge distance for the anchor used in the hold-down connector shall be provided in the concrete or masonry below any plain concrete slab unless satisfactory evidence is submitted to the *code official* that shows that the concrete slab and footings are of monolithic construction.

A403.10 Steel retrofit systems. Steel retrofit systems shall have strength and stiffness sufficient to resist the seismic loads and shall conform to the requirements of this section.

A403.10.1 Special moment frames. Steel special moment frames shall comply with all applicable provisions of AISC 341, except that Section E3.4a addressing strong-column/weak-beams of AISC 341, is not required for columns that carry no gravity load.

A403.10.2 Inverted moment frame systems. Cantilevered column systems shall be permitted to be designed as inverted special, intermediate or ordinary moment frames, with corresponding moment frame seismic design coefficients, where the system satisfies the following conditions:

1. The columns carry no gravity load.
2. The columns are configured in pairs or larger groups connected by a continuous reinforced concrete foundation or grade beam.
3. The foundation or grade beam shall be designed to resist the expected plastic moment at the base of each column, computed as $R_y F_y Z$ in accordance with AISC 341.
4. The flexibility of the foundation or grade beam, considering cracked section properties of the reinforced concrete, shall be included in computing the deformation of the steel frame system.
5. The column height shall be taken as twice the actual height when checking lateral torsional buckling.

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SECTION A404—PRESCRIPTIVE MEASURES FOR WEAK STORY

[BS] A404.1 Limitation. These prescriptive measures shall apply only to two-story buildings and only where deemed appropriate by the *code official*. These prescriptive measures rely on rotation of the second floor diaphragm to distribute the seismic load between the side and rear walls around a ground floor open area. In the absence of an existing floor diaphragm of wood structural panel or diagonal sheathing at the top of the first story, a new wood structural panel diaphragm of minimum thickness of $^3/_4$ inch (19.1 mm) and with 10d common nails at 6 inches (152 mm) on center shall be applied.

[BS] A404.1.1 Additional conditions. To qualify for these prescriptive measures, the following additional conditions need to be satisfied by the retrofitted structure:

1. Diaphragm aspect ratio *L/W* is less than 0.67, where *W* is the diaphragm dimension parallel to the soft, weak or open-front wall line and *L* is the distance in the orthogonal direction between that wall line and the rear wall of the ground floor open area.
2. Minimum length of side shear walls = 20 feet (6096 mm).
3. Minimum length of rear shear wall = three-fourths of the total rear wall length.
4. Plan or vertical irregularities shall not be other than a soft, weak or open-front wall line.
5. Roofing weight less than or equal to 5 pounds per square foot (240 N/m^2).
6. Aspect ratio of the full second floor diaphragm meets the requirements of the building code for new construction.

[BS] A404.2 Minimum required retrofit.

[BS] A404.2.1 Anchor size and spacing. The anchor size and spacing shall be not less than $^3/_4$ inch (19.1 mm) in diameter at 32 inches (813 mm) on center. Where existing anchors are inadequate, supplemental or alternative *approved* connectors (such as new steel plates bolted to the side of the foundation and nailed to the sill) shall be used.

[BS] A404.2.2 Connection to floor above. Shear wall top plates shall be connected to blocking or rim joist at upper floor with not less than 18-gage galvanized steel angle clips $4^1/_2$ inches (114 mm) long with 12-8d nails spaced not farther than 16 inches (406 mm) on center, or by equivalent shear transfer methods.

[BS] A404.2.3 Shear wall sheathing. The shear wall sheathing shall be not less than $^{15}/_{32}$-inch (11.9 mm), 5-ply Structural I with 10d nails at 4 inches (102 mm) on center at edges and 12 inches (305 mm) on center at field; blocked all edges with 3 by 4 board or larger. Where existing sill plates are less than 3-by thick, place flat 2-by on top of sill between studs, with flat 18-gage galvanized steel clips $4^1/_2$ inches (114 mm) long with 12-8d nails or $^3/_8$-inch-diameter (9.5 mm) lags through blocking for shear transfer to sill plate. Stagger nailing from wall sheathing between existing sill and new blocking. Anchor new blocking to foundation as specified in this section.

[BS] A404.2.4 Shear wall hold-downs. Shear walls shall be provided with hold-down anchors at each end. Two hold-down anchors are required at intersecting corners. Hold-downs shall be *approved* connectors with a minimum $^5/_8$-inch-diameter (15.9 mm) threaded rod or other *approved* anchor with a minimum allowable load of 4,000 pounds (17.8 kN). Anchor embedment in concrete shall be not less than 5 inches (127 mm). Tie-rod systems shall be not less than $^5/_8$ inch (15.9 mm) in diameter unless using high-strength cable. High-strength cable elongation shall not exceed $^5/_8$ inch (15.9 mm) under a 4,000 pound (17.8 kN) axial load.

SECTION A405—MATERIALS OF CONSTRUCTION

[BS] A405.1 New materials. New materials shall meet the requirements of the *Building Code of New York State*, except where allowed by this chapter.

[BS] A405.2 Allowable foundation and lateral pressures. The use of default values from the building code for continuous and isolated concrete spread footings shall be permitted. For soil that supports embedded vertical elements, Section A403.4.1 shall apply.

[BS] A405.3 Existing materials. The physical condition, strengths and stiffnesses of existing building materials shall be taken into account in any analysis required by this chapter. The verification of existing materials conditions and their conformance to these requirements shall be made by physical observation, material testing or record drawings as determined by the registered design professional subject to the approval of the *code official*.

[BS] A405.3.1 Wood-structural-panel shear walls.

[BS] A405.3.1.1 Existing nails. Where the required calculations rely on design values for common nails or surfaced dry lumber, their use in construction shall be verified by exposure.

[BS] A405.3.1.2 Existing plywood. Where verification of the existing plywood is by use of record drawings alone, plywood shall be assumed to be of three plies.

[BS] A405.3.2 Existing wood framing. Wood framing is permitted to use the design stresses specified in the building code under which the building was constructed or other stress criteria *approved* by the *code official*.

[BS] A405.3.3 Existing structural steel. All existing structural steel shall be permitted to be assumed to comply with ASTM A36. Existing pipe or tube columns shall be assumed to be of minimum wall thickness unless verified by testing or exposure.

[BS] A405.3.4 Existing concrete. All existing concrete footings shall be permitted to be assumed to be plain concrete with a compressive strength of 2,000 pounds per square inch (13.8 MPa). Existing concrete compressive strength taken greater than 2,000 pounds per square inch (13.8 MPa) shall be verified by testing, record drawings or department records.

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[BS] A405.3.5 Existing sill plate anchorage. The analysis of existing cast-in-place anchors shall be permitted to assume proper anchor embedment for purposes of evaluating shear resistance to lateral loads.

SECTION A406—CONSTRUCTION DOCUMENTS

[BS] A406.1 General. The plans shall show all information necessary for plan review and for construction and shall accurately reflect the design. The plans shall contain a note that states that this retrofit was designed in compliance with the criteria of this chapter.

[BS] A406.2 Existing construction. The plans shall show existing diaphragm and shear wall sheathing and framing materials; fastener type and spacing; diaphragm and shear wall connections; continuity ties; collector elements; and the portion of the existing materials that needs verification during construction. If the cap allowed by Section A403.3.1 is used to limit the scope of retrofit, the foregoing information shall be shown for each retrofitted story and at least one story above the uppermost retrofitted story. If the cap allowed by Section A403.3.1 is not used, the foregoing information need only be shown for each retrofitted story and for the floor at the top of that story.

[BS] A406.3 New construction.

[BS] A406.3.1 Foundation plan elements. The foundation plan shall include the size, type, location and spacing of all anchor bolts with the required depth of embedment, edge and end distance; the location and size of all shear walls and all columns for braced frames or moment frames; referenced details for the connection of shear walls, braced frames or moment-resisting frames to their footing; and referenced sections for any grade beams and footings.

[BS] A406.3.2 Framing plan elements. The framing plan shall include the length, location and material of shear walls; the location and material of frames; references or details for the column-to-beam connectors, beam-to-wall connections and shear transfers at floor and roof diaphragms; and the required nailing and length for wall top plate splices.

[BS] A406.3.3 Shear wall schedule, notes and details. Shear walls shall have a referenced schedule on the plans that includes the correct shear wall capacity in pounds per foot (N/m); the required fastener type, length, gage and head size; and a complete specification for the sheathing material and its thickness. The schedule shall also show the required location of 3-inch (76 mm) nominal or two 2-inch (51 mm) nominal edge members; the spacing of shear transfer elements such as framing anchors or added sill plate nails; the required hold-down with its bolt, screw or nail sizes; and the dimensions, lumber grade and species of the attached framing member.

Notes shall show required edge distance for fasteners of structural wood panels and framing members; required flush nailing at the plywood surface; limits of mechanical penetrations; and the sill plate material assumed in the design. The limits of mechanical penetrations shall be detailed showing the maximum notching and drilled hole sizes.

[BS] A406.3.4 General notes. General notes shall show the requirements for material testing, special inspection and structural observation.

SECTION A407—QUALITY CONTROL

[BS] A407.1 Structural observation. Structural observation, in accordance with Section 1704.6 of the *Building Code of New York State* is required, regardless of seismic design category, height or other conditions. Structural observation shall include visual observation of work for conformance to the *approved* construction documents and confirmation of existing conditions assumed during design.

A407.2 Contractor responsibility. Contractor responsibility shall be in accordance with Section 1704.4 of the *Building Code of New York State*.

A407.3 Testing and inspection. Structural testing and inspection for new construction materials, submittals, reports and certificates of compliance shall be in accordance with Sections 1704 and 1705 of the *Building Code of New York State*. Work done to comply with this chapter shall not be eligible for Exceptions 1, 2, or 3 of Section 1704.2 of the *Building Code of New York State* or for the exception to Section 1705.13.2 of the *Building Code of New York State*.

[NY] CHAPTER A5 RESERVED

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APPENDIX

B

SUPPLEMENTARY ACCESSIBILITY REQUIREMENTS FOR EXISTING BUILDINGS AND FACILITIES

This appendix is informative and is not part of this code.

User notes:

About this appendix: *Chapter 11 of the International Building Code® contains provisions that set forth requirements for accessibility to buildings and their associated sites and facilities for people with physical disabilities. Sections 306 and 1511 in the code address accessibility provisions and alternatives permitted in existing buildings. Appendix B was added to address accessibility in construction for items that are not typically enforceable through the traditional building code enforcement process.*

SECTION B101—QUALIFIED HISTORIC BUILDINGS AND FACILITIES

[BE] B101.1 General. Qualified *historic buildings* and *facilities* shall comply with Sections B101.2 through B101.5.

[BE] B101.2 Qualified historic buildings and facilities. These procedures shall apply to buildings and *facilities* designated as historic structures that undergo *alterations* or a *change of occupancy*.

[BE] B101.3 Qualified historic buildings and facilities subject to Section 106 of the National Historic Preservation Act. Where an *alteration* or *change of occupancy* is undertaken to a qualified *historic building* or *facility* that is subject to Section 106 of the National Historic Preservation Act, the federal agency with jurisdiction over the undertaking shall follow the Section 106 process. Where the state historic preservation officer or Advisory Council on Historic Preservation determines that compliance with the requirements for accessible routes, ramps, entrances, or toilet facilities would threaten or destroy the historic significance of the building or *facility*, the alternative requirements of Section 306.7.16 for that element are permitted.

[BE] B101.4 Qualified historic buildings and facilities not subject to Section 106 of the National Historic Preservation Act. Where an *alteration* or *change of occupancy* is undertaken to a qualified *historic building* or *facility* that is not subject to Section 106 of the National Historic Preservation Act, and the entity undertaking the *alterations* believes that compliance with the requirements for accessible routes, ramps, entrances or toilet facilities would threaten or destroy the historic significance of the building or *facility*, the entity shall consult with the state historic preservation officer. Where the state historic preservation officer determines that compliance with the accessibility requirements for accessible routes, ramps, entrances or toilet facilities would threaten or destroy the historical significance of the building or *facility*, the alternative requirements of Section 306.7.18 for that element are permitted.

[BE] B101.4.1 Consultation with interested persons. Interested persons shall be invited to participate in the consultation process, including state or local accessibility officials, individuals with disabilities, and organizations representing individuals with disabilities.

[BE] B101.4.2 Certified local government historic preservation programs. Where the state historic preservation officer has delegated the consultation responsibility for purposes of this section to a local government historic preservation program that has been certified in accordance with Section 101 of the National Historic Preservation Act of 1966 [(16 U.S.C. 470a(c)] and implementing regulations (36 CFR 61.5), the responsibility shall be permitted to be carried out by the appropriate local government body or official.

[BE] B101.5 Displays. In qualified *historic buildings* and *facilities* where alternative requirements of Section 306.7.16 are permitted, displays and written information shall be located where they can be seen by a seated person. Exhibits and signs displayed horizontally shall be 44 inches (1120 mm) maximum above the floor.

SECTION B102—FIXED TRANSPORTATION FACILITIES AND STATIONS

[BE] B102.1 General. Existing fixed transportation *facilities* and stations shall comply with Section B102.2.

[BE] B102.2 Existing facilities—key stations. Rapid rail, light rail, commuter rail, intercity rail, high-speed rail and other fixed guideway systems, altered stations, and intercity rail and key stations, as defined under criteria established by the Department of Transportation in Subpart C of 49 CFR Part 37, shall comply with Sections B102.2.1 through B102.2.3.

[BE] B102.2.1 Accessible route. One accessible route, or more, from an accessible entrance to those areas necessary for use of the transportation system shall be provided. The accessible route shall include the features specified in Section E109.2 of the *International Building Code*, except that escalators shall comply with Section 3004.2.2 of the *International Building Code*. Where technical unfeasibility in existing stations requires the accessible route to lead from the public way to a paid area of the transit system, an accessible fare collection machine complying with Section E109.2.3 of the *International Building Code* shall be provided along such accessible route.

[BE] B102.2.2 Platform and vehicle floor coordination. Station platforms shall be positioned to coordinate with vehicles in accordance with applicable provisions of 36 CFR Part 1192. Low-level platforms shall be 8 inches (250 mm) minimum above top of rail.

Exception: Where vehicles are boarded from sidewalks or street-level, low-level platforms shall be permitted to be less than 8 inches (250 mm).

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[BE] B102.2.3 Direct connections. New direct connections to commercial, retail or residential *facilities* shall, to the maximum extent feasible, have an accessible route complying with Section 306.7.1 from the point of connection to boarding platforms and transportation system elements used by the public. Any elements provided to facilitate future direct connections shall be on an accessible route connecting boarding platforms and transportation system elements used by the public.

SECTION B103—DWELLING UNITS AND SLEEPING UNITS

[BE] B103.1 Communication features. Where dwelling units and sleeping units are altered or added, the requirements of Section E104.2 of the *International Building Code* shall apply only to the units being altered or added until the number of units with accessible communication features complies with the minimum number required for new construction.

[NY] SECTION B104—ENHANCED CLASSROOM ACOUSTICS

[NY] B104.1 Alterations. For all levels of *alterations* in Group E occupancies, where the *work area* exceeds 50 percent of the building area, enhanced classroom acoustics shall be provided in all classrooms with a volume of 20,000 cubic feet (565 m^3) or less. Enhanced classroom acoustics shall comply with the reverberation time in Section 808 of ICC A117.1.

[NY] B104.2 Additions. For *additions* in Group E occupancies, enhanced classroom acoustics shall be provided in all classrooms in the addition with a volume of 20,000 cubic feet (565 m^3) or less. Enhanced classroom acoustics shall comply with the reverberation time in Section 808 of ICC A117.1.

[NY] SECTION B105—REFERENCED STANDARDS

[NY] B105.1 General. See Table B104.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

[NY]TABLE B105.1—REFERENCED STANDARDS

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
Y3.H626 2P	*National Historic Preservation J101.2, 43/933 Act of 1966 as amended J101.3, 3rd Edition*	B101.3, B101.4, B101.4.2
IBC—24	*International Building Code®*	B102.2.1, B103.1
ICC A117.1-2017	*Accessible and Usable Buildings and Facilities*	B104.1, B104.2
36 CFR Part 1192	*Americans with Disabilities Act Guidelines for Transportation Vehicles—Rapid Rail Vehicles and Systems*	B102.2.2
49 CFR Part 37 Subpart C	*Alteration of Transportation Facilities by Public Entities Department of Transportation*	B102.2

APPENDIX

C

GUIDELINES FOR THE WIND RETROFIT OF EXISTING BUILDINGS

This appendix is informative and is not part of this code.

User notes:

About this appendix: *Appendix C is intended to provide guidance for retrofitting existing structures to strengthen their resistance to wind forces. This appendix is similar in scope to Appendix A, which addresses seismic retrofits for existing buildings, except that the subject matter is related to wind retrofits. These retrofits are voluntary measures that serve to better protect the public and reduce damage from high-wind events for existing buildings.*

The purpose of this appendix is to provide prescriptive alternatives for addressing retrofit of buildings in high-wind areas. Currently there are two chapters that deal with the retrofit of gable ends and the fastening of roof decks, Appendix Chapters C1 and C2, respectively.

CHAPTER C1 GABLE END RETROFIT FOR HIGH-WIND AREAS

SECTION C101—GENERAL

[BS] C101.1 Purpose. This chapter provides prescriptive methods for partial structural retrofit of an *existing building* to increase its resistance to out-of-plane wind loads. It is intended for voluntary use and for reference by mitigation programs. The provisions of this chapter do not necessarily satisfy requirements for new construction. Unless specifically cited, the provisions of this chapter do not necessarily satisfy requirements for structural improvements triggered by *addition, alteration, repair, change of occupancy*, building relocation or other circumstances.

[BS] C101.2 Eligible buildings and gable end walls. The provisions of this chapter are applicable only to buildings that meet the following eligibility requirements:

1. The building is not more than three stories tall, from adjacent grade to the bottom plate of each gable end wall being retrofitted with this chapter.
2. The building is classified as Occupancy Group R3 or is within the scope of the *International Residential Code*.
3. The structure includes one or more wood-framed gable end walls, either conventionally framed or metal-plate-connected.

In addition, the provisions of this chapter are applicable only to gable end walls that meet the following eligibility requirements:

1. Each gable end wall has or shall be provided with studs or vertical webs spaced 24 inches (610 mm) on center maximum.
2. Each gable end wall has a maximum height of 16 feet (4877 mm).

[BS] C101.3 Compliance Eligible gable end walls in eligible buildings may be retrofitted in accordance with this chapter. Other modifications required for compliance with this chapter shall be designed and constructed in accordance with the *International Building Code* or *International Residential Code* provisions for new construction, except as specifically provided for by this chapter.

SECTION C102—DEFINITIONS

[BS] C102.1 Definitions. The following words and terms shall, for the purposes of this chapter, have the meanings shown herein.

[BS] ANCHOR BLOCK. A piece of lumber secured to horizontal braces and filling the gap between existing framing members for the purpose of restraining horizontal braces from movement perpendicular to the framing members.

[BS] COMPRESSION BLOCK. A piece of lumber used to restrain in the compression mode (force directed toward the interior of the attic) an existing or retrofit stud. It is attached to a horizontal brace and bears directly against the existing or retrofit stud.

[BS] CONVENTIONALLY FRAMED GABLE END. A gable end framed with studs whose faces are perpendicular to the gable end wall.

[BS] GABLE END FRAME. A factory or site-fabricated frame, installed as a complete assembly that incorporates vertical webs with their faces parallel to the plane of the frame.

[BS] HORIZONTAL BRACE. A piece of lumber used to restrain both compression and tension loads applied by a retrofit stud. It is typically installed horizontally on the top of attic floor framing members (truss bottom chords or ceiling joists) or on the bottom of pitched roof framing members (truss top chord or rafters).

[BS] HURRICANE TIES. Manufactured metal connectors designed to provide uplift and lateral restraint for roof framing members.

[BS] NAIL PLATE. A manufactured metal plate made of galvanized steel with factory-punched holes for fasteners. A nail plate may have the geometry of a strap.

[BS] RETROFIT. The voluntary process of strengthening or improving buildings or structures, or individual components of buildings or structures for the purpose of making existing conditions better serve the purpose for which they were originally intended or the purpose that current building codes intend.

[BS] RETROFIT STUD. A lumber member used to structurally supplement an existing gable end wall stud or gable end frame web.

[BS] STUD-TO-PLATE CONNECTOR. A manufactured metal connector designed to connect studs to plates.

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SECTION C103—MATERIALS OF CONSTRUCTION

[BS] C103.1 Existing materials. Existing wood materials that will be part of the retrofitting work (such as trusses, rafters, ceiling joists, top plates and wall studs) shall be in sound condition and free from defects or damage that substantially reduces the load-carrying capacity of the member. Any wood materials found to be damaged or deteriorated shall be strengthened or replaced with new materials to provide a net dimension of sound wood equivalent to its undamaged original dimensions.

[BS] C103.2 New materials. All new materials shall comply with the standards for those materials as specified in the *International Building Code* or the *International Residential Code*.

[BS] C103.3 Material specifications for retrofits. Materials for retrofitting gable end walls shall comply with Table C103.3.

[BS] TABLE C103.3—MATERIAL SPECIFICATIONS FOR RETROFITS[a]

COMPONENT	MINIMUM SIZE OR THICKNESS	MINIMUM MATERIAL GRADE	MINIMUM CAPACITY
Anchor blocks, compression blocks and horizontal braces	2 × 4 nominal lumber	#2 Spruce-Pine-Fir or better	NA
Nail plates	20 gage thickness 8d minimum nail holes	Galvanized sheet steel	NA
Retrofit studs	2 × 4 nominal lumber	#2 Spruce-Pine-Fir or better	NA
Gusset angle	14 gage thickness	Galvanized sheet steel	350 pounds uplift and lateral load
Stud-to-plate connector	20 gage thickness	Galvanized sheet steel	500 pounds uplift
Metal plate connectors, straps and anchors	20 gage thickness	Galvanized sheet steel	NA

For SI: 1 pound = 4.4 N.
NA = Not Applicable.
a. Metal plate connectors, nail plates, stud-to-plate connectors, straps and anchors shall be products approved for connecting wood-to-wood or wood-to-concrete as appropriate.

[BS] C103.4 Twists in straps. Straps shall be permitted to be twisted or bent where they transition between framing members or connection points. Straps shall be bent only once at a given location though it is permissible that they be bent or twisted at multiple locations along their length.

[BS] C103.5 Fasteners. Fasteners shall meet the requirements of Table C103.5, Sections C103.5.1 and C103.5.2, and shall be permitted to be screws or nails meeting the minimum length requirement shown in the figures and specified in the tables of this appendix. Fastener spacing shall meet the requirements of Section C103.5.3.

[BS]TABLE C103.5—NAIL AND SCREW REQUIREMENTS

FASTENER TYPE	MINIMUM SHANK DIAMETER	MINIMUM HEAD DIAMETER	MINIMUM FASTENER LENGTH
#8 screws	NA	0.28 inches	$1^1/_4$ inches
8d common nails	0.131 inches	0.28 inches	$2^1/_2$ inches
10d common nails	0.148 inches	0.28 inches	3 inches

For SI: 1 inch = 25.4 mm.
NA = Not Applicable.

[BS] C103.5.1 Screws. Unless otherwise indicated in the appendix, screw sizes and lengths shall be in accordance with Table C103.5. Permissible screws include deck screws and wood screws. Screws shall have not less than 1 inch (25 mm) of thread. Fine threaded screws or drywall screws shall not be permitted. Select the largest possible diameter screw such that the shank adjacent to the head fits through the hole in the strap.

[BS] C103.5.2 Nails. Unless otherwise indicated in this appendix, nail sizes and lengths shall be in accordance with Table C103.5.

[BS] C103.5.3 General fastener spacing. Fastener spacing for shear connections of lumber-to-lumber shall meet the requirements shown in Figure C103.5.3 and the following conditions.

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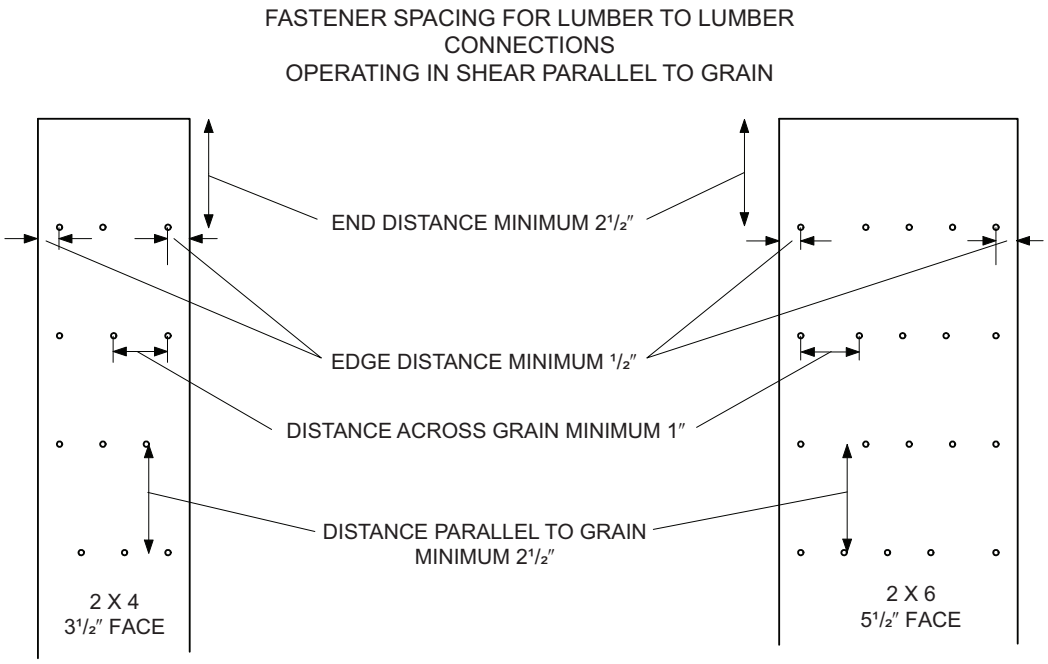
[BS] FIGURE C103.5.3—FASTENER SPACINGS FOR LUMBER-TO-LUMBER CONNECTIONS OPERATING IN SHEAR PARALLEL TO GRAIN



For SI: 1 inch = 25.4 mm.

[BS] C103.5.3.1 General fastener spacing. Fastener spacing shall meet the following conditions except as provided for in Section C103.5.3.

The distance between fasteners and the edge of lumber that is less than $3^1/_2$ inches (89 mm) deep in the direction of the fastener length shall be not less than $^3/_4$ inch (19.1 mm).

1. The distance between fasteners and the edge of lumber that is more than 2 inches (51 mm) thick in the direction of the fastener length shall be not less than $^1/_2$ inch (12.7 mm).
2. The distance between a fastener and the end of lumber shall be not less than $2^1/_2$ inches (64 mm).
3. The distance between fasteners parallel to the grain (center-to-center) shall be not less than $2^1/_2$ inches (64 mm).
4. The distance between fasteners perpendicular to the grain (center-to-center) in lumber that is less than $3^1/_2$ inches (89 mm) deep in the direction of the fastener length shall be 1 inch (25 mm).
5. The distance between fasteners perpendicular to the grain (center-to-center) in lumber that is more than 2 inches (51 mm) thick in the direction of the fastener length shall be $^1/_2$ inch (12.7 mm).

[BS] C103.5.3.2 Wood-to-wood connections of two members each 2 inches or less in thickness. Wood-to-wood connections fastener spacing shall meet the following conditions:

1. The distance between fasteners parallel to grain (center-to-center) shall be not less than $2^1/_2$ inches (64 mm).
2. The distance between fasteners across grain (center-to-center) shall be not less than 1 inch (25 mm).
3. For wood-to-wood connections of lumber at right angles, fasteners shall be spaced not less than $2^1/_2$ inches (64 mm) parallel to the grain and 1 inch (25 mm) perpendicular to the grain in any direction.

[BS] C103.5.3.3 Metal connectors for wood-to-wood connections. Metal connectors for wood-to-wood connections shall meet the following conditions.

1. Fastener spacing to edge or ends of lumber shall be as dictated by the prefabricated holes in the connectors and the connectors shall be installed in a configuration that is similar to that shown by the connector manufacturer.
2. Fasteners in $1^1/_4$-inch-wide (32 mm) metal straps that are installed on the narrow face of lumber shall be a minimum $^1/_4$ inch (6.4 mm) from either edge of the lumber. Consistent with Section C103.5.3.1, fasteners shall be permitted to be spaced according to the fastener holes fabricated into the strap.
3. Fasteners in metal nail plates shall be spaced not less than $^1/_2$ inch (12.7 mm) perpendicular to grain and not less than $1^1/_2$ inches (38 mm) parallel to grain.

SECTION C104—RETROFITTING GABLE END WALLS TO ENHANCE WIND RESISTANCE

[BS] C104.1 General. These prescriptive methods of retrofitting are intended to increase the resistance of existing gable end construction for out-of-plane wind loads resulting from high-wind events. The ceiling diaphragm shall be comprised of minimum $^1/_2$-inch-thick (12.7 mm) gypsum board, minimum nominal $^3/_8$-inch-thick (9.5 mm) wood structural panels, or plaster. An overview isometric drawing of one type of gable end retrofit to improve wind resistance is shown in Figure C104.1.

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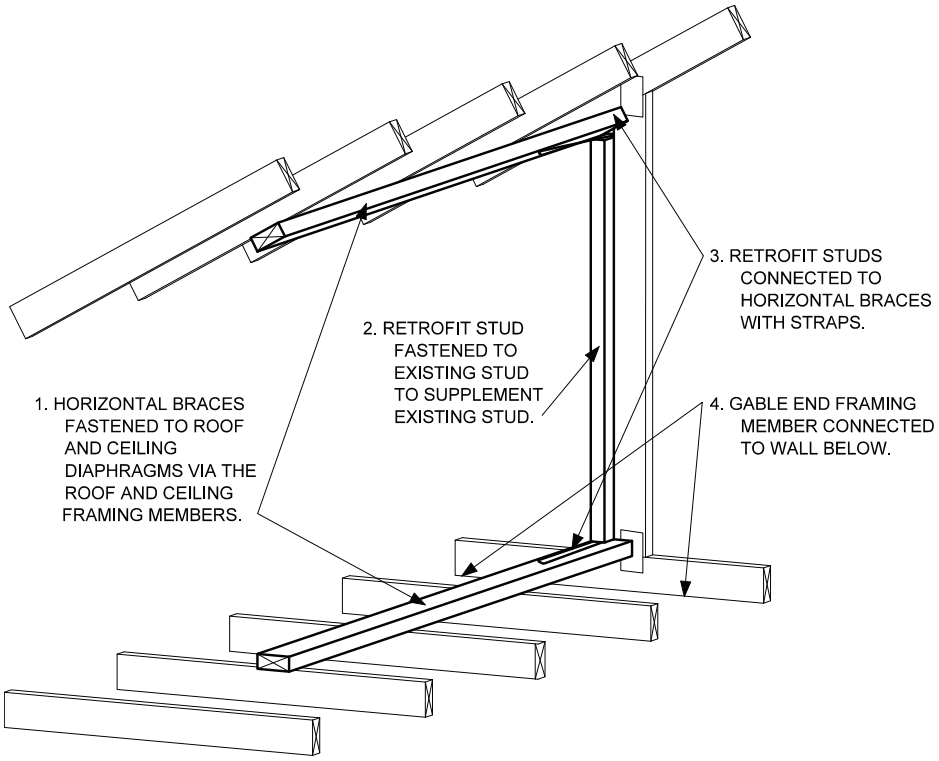
[BS] FIGURE C104.1—BASIC GABLE END RETROFIT METHODOLOGY


3. RETROFIT STUDS CONNECTED TO HORIZONTAL BRACES WITH STRAPS.
2. RETROFIT STUD FASTENED TO EXISTING STUD TO SUPPLEMENT EXISTING STUD.
1. HORIZONTAL BRACES FASTENED TO ROOF AND CEILING DIAPHRAGMS VIA THE ROOF AND CEILING FRAMING MEMBERS.
4. GABLE END FRAMING MEMBER CONNECTED TO WALL BELOW.

THIS FIGURE SHOWS A TRUSS GABLE END.
THE METHODOLOGY FOR A CONVENTIONALLY FRAMED GABLE END IS SIMILAR.
THE NUMBERS INDICATE A TYPICAL SEQUENCE OF INSTALLATION.
IN ORDER TO SHOW STRAPS COMPRESSION BLOCKS ARE NOT SHOWN.

[BS] C104.2 Horizontal braces. Horizontal braces shall be installed perpendicular to the roof and ceiling framing members at the location of each existing gable end stud greater than 3 feet (91 cm) in length. Unless it is adjacent to an omitted horizontal brace location, horizontal braces shall be minimum 2-inch by 4-inch (38 mm by 89 mm) dimensional lumber as defined in Section C103.3. A single horizontal brace is required at the top and bottom of each gable end stud for Retrofit Configuration A, B, or C. Two horizontal braces are required at the top and bottom of each gable end stud for Retrofit Configuration D. Maximum heights of gable end wall studs and associated retrofit studs for each Retrofit Configuration shall not exceed the values listed in Table C104.2. Horizontal braces shall be oriented with their wide faces across the roof or ceiling framing members, be fastened to not fewer than three framing members, and extend not less than 6 feet (183 cm) measured perpendicularly from the gable end plus $2^{1}/_{2}$ inches (64 mm) beyond the last top chord or bottom chord member (rafter or ceiling joist) from the gable end as shown in Figures C104.2(1), C104.2(2), C104.2(3) and C104.2(4).

[BS] TABLE C104.2—STUD LENGTH LIMITATIONS BASED ON EXPOSURE AND DESIGN WIND SPEED

EXPOSURE CATEGORY	MAXIMUM 3-SEC GUST BASIC WIND SPEED[a]	MAXIMUM HEIGHT OF GABLE END RETROFIT STUD[b]			
C	140	8′-0″	11′-3″	14′-9″	16′-0″
C	150	7′-6″	10′-6″	13′-6″	16′-0″
C	165	7′-0″	10′-0″	12′-3″	16′-0″
C	180	7′-0″	10′-0″	12′-3″	16′-0″
C	190	6′-6″	8′-9″	11′-0″	16′-0″
B	140	8′-0″	12′-3″	16′-0″	NR[c]
B	150	8′-0″	11′-3″	14′-9″	16′-0″
B	165	8′-0″	11′-3″	14′-9″	16′-0″
B	180	7′-6″	10′-6″	13′-6″	16′-0″
B	190	7′-0″	10′-0″	12′-3″	16′-0″

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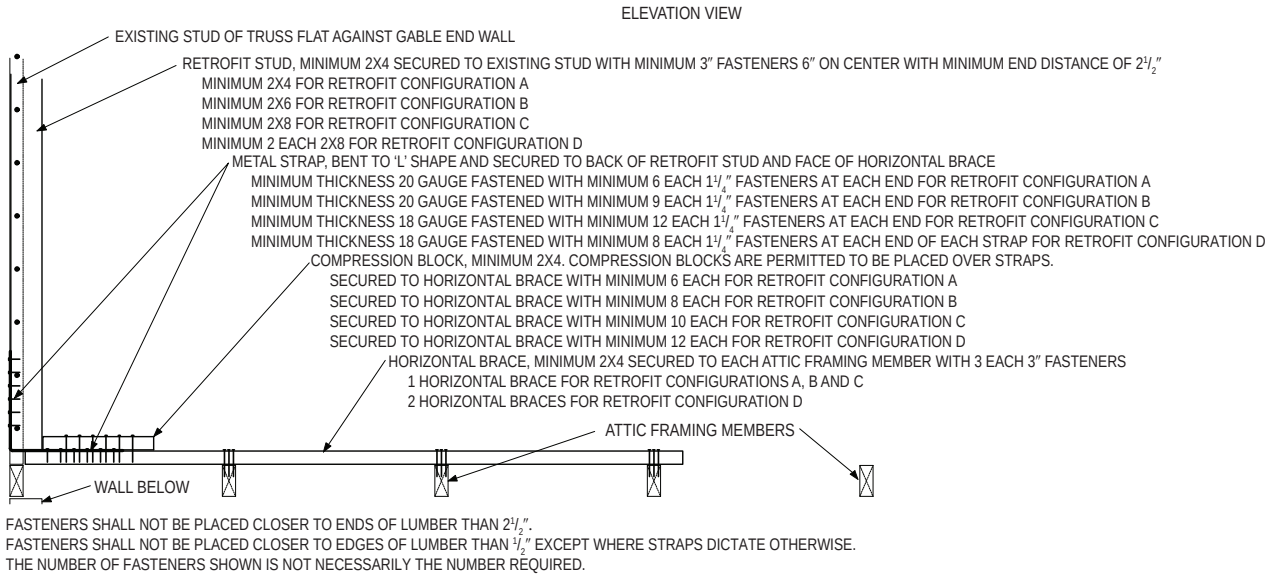
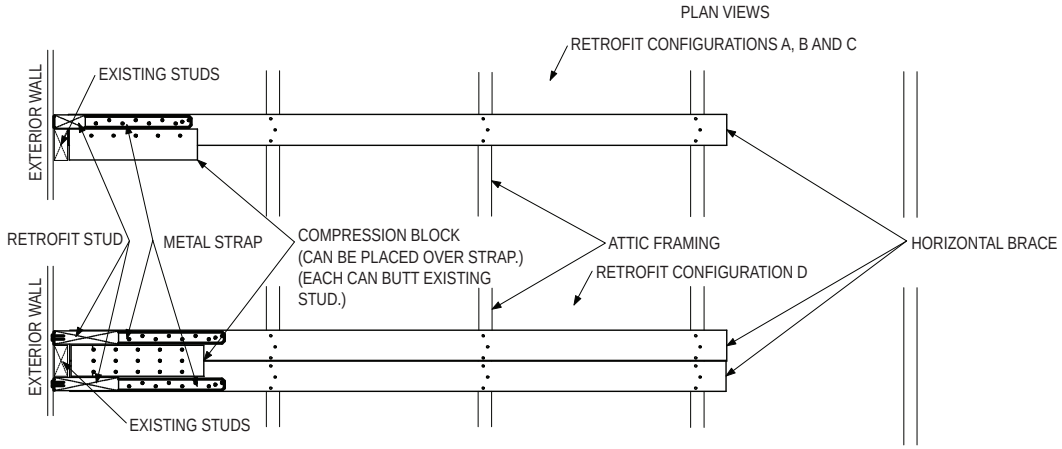
[BS] TABLE C104.2—STUD LENGTH LIMITATIONS BASED ON EXPOSURE AND DESIGN WIND SPEED—continued					
EXPOSURE CATEGORY	MAXIMUM 3-SEC GUST BASIC WIND SPEED[a]	MAXIMUM HEIGHT OF GABLE END RETROFIT STUD[b]			
	Retrofit Configuration	A	B	C	D

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.
NR = Not Required.
a. Interpolation between given wind speeds is not permitted.
b. Existing gable end studs less than or equal to 3 feet 0 inches in height shall not require retrofitting.
c. Configuration C is acceptable to 16 feet 0 inches maximum height.

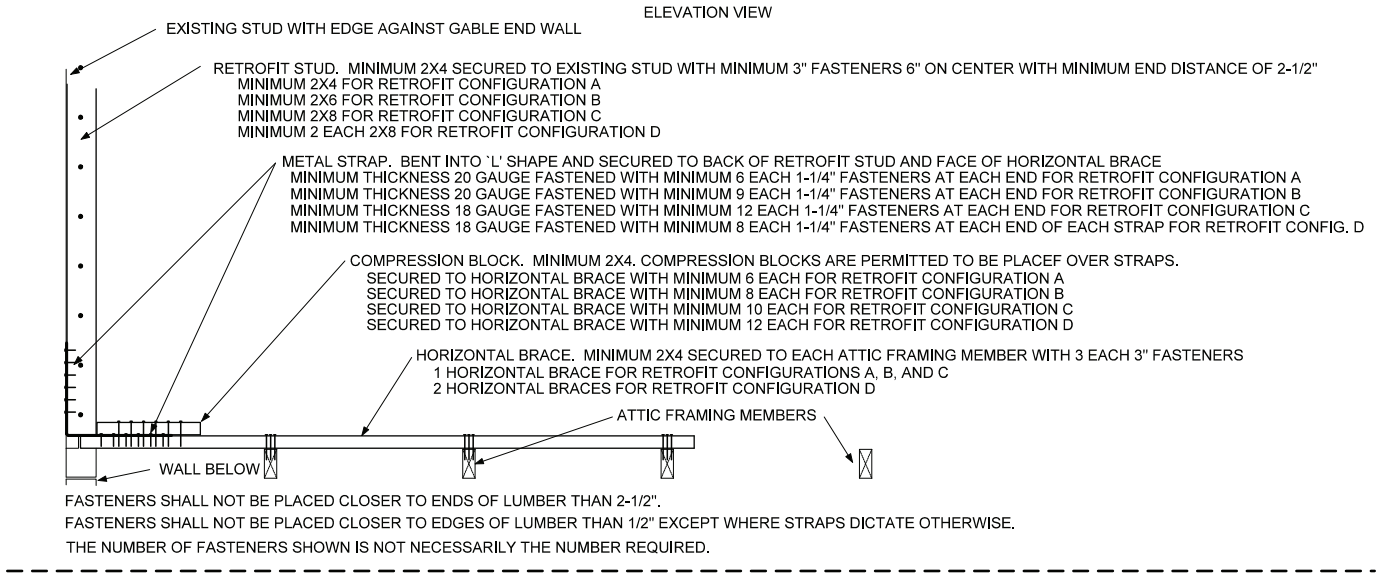
[BS] FIGURE C104.2(1)TRUSS FRAMED GABLE END


ELEVATION VIEW
EXISTING STUD OF TRUSS FLAT AGAINST GABLE END WALL
RETROFIT STUD, MINIMUM 2X4 SECURED TO EXISTING STUD WITH MINIMUM 3″ FASTENERS 6″ ON CENTER WITH MINIMUM END DISTANCE OF 2 1/2″
MINIMUM 2X4 FOR RETROFIT CONFIGURATION A
MINIMUM 2X6 FOR RETROFIT CONFIGURATION B
MINIMUM 2X8 FOR RETROFIT CONFIGURATION C
MINIMUM 2 EACH 2X8 FOR RETROFIT CONFIGURATION D
METAL STRAP, BENT TO 'L' SHAPE AND SECURED TO BACK OF RETROFIT STUD AND FACE OF HORIZONTAL BRACE
MINIMUM THICKNESS 20 GAUGE FASTENED WITH MINIMUM 6 EACH 1 1/4″ FASTENERS AT EACH END FOR RETROFIT CONFIGURATION A
MINIMUM THICKNESS 20 GAUGE FASTENED WITH MINIMUM 9 EACH 1 1/4″ FASTENERS AT EACH END FOR RETROFIT CONFIGURATION B
MINIMUM THICKNESS 18 GAUGE FASTENED WITH MINIMUM 12 EACH 1 1/4″ FASTENERS AT EACH END FOR RETROFIT CONFIGURATION C
MINIMUM THICKNESS 18 GAUGE FASTENED WITH MINIMUM 8 EACH 1 1/4″ FASTENERS AT EACH END OF EACH STRAP FOR RETROFIT CONFIGURATION D
COMPRESSION BLOCK, MINIMUM 2X4. COMPRESSION BLOCKS ARE PERMITTED TO BE PLACED OVER STRAPS.
SECURED TO HORIZONTAL BRACE WITH MINIMUM 6 EACH FOR RETROFIT CONFIGURATION A
SECURED TO HORIZONTAL BRACE WITH MINIMUM 8 EACH FOR RETROFIT CONFIGURATION B
SECURED TO HORIZONTAL BRACE WITH MINIMUM 10 EACH FOR RETROFIT CONFIGURATION C
SECURED TO HORIZONTAL BRACE WITH MINIMUM 12 EACH FOR RETROFIT CONFIGURATION D
HORIZONTAL BRACE, MINIMUM 2X4 SECURED TO EACH ATTIC FRAMING MEMBER WITH 3 EACH 3″ FASTENERS
1 HORIZONTAL BRACE FOR RETROFIT CONFIGURATIONS A, B AND C
2 HORIZONTAL BRACES FOR RETROFIT CONFIGURATION D
ATTIC FRAMING MEMBERS
WALL BELOW
FASTENERS SHALL NOT BE PLACED CLOSER TO ENDS OF LUMBER THAN 2 1/2″.
FASTENERS SHALL NOT BE PLACED CLOSER TO EDGES OF LUMBER THAN 1/2″ EXCEPT WHERE STRAPS DICTATE OTHERWISE.
THE NUMBER OF FASTENERS SHOWN IS NOT NECESSARILY THE NUMBER REQUIRED.



For SI: 1 inch = 25.4 mm.

[BS] FIGURE C104.2(2)—CONVENTIONALLY FRAMED GABLE END L-BENT STRAP


ELEVATION VIEW
EXISTING STUD WITH EDGE AGAINST GABLE END WALL
RETROFIT STUD. MINIMUM 2X4 SECURED TO EXISTING STUD WITH MINIMUM 3" FASTENERS 6" ON CENTER WITH MINIMUM END DISTANCE OF 2-1/2"
MINIMUM 2X4 FOR RETROFIT CONFIGURATION A
MINIMUM 2X6 FOR RETROFIT CONFIGURATION B
MINIMUM 2X8 FOR RETROFIT CONFIGURATION C
MINIMUM 2 EACH 2X8 FOR RETROFIT CONFIGURATION D
METAL STRAP. BENT INTO `L' SHAPE AND SECURED TO BACK OF RETROFIT STUD AND FACE OF HORIZONTAL BRACE
MINIMUM THICKNESS 20 GAUGE FASTENED WITH MINIMUM 6 EACH 1-1/4" FASTENERS AT EACH END FOR RETROFIT CONFIGURATION A
MINIMUM THICKNESS 20 GAUGE FASTENED WITH MINIMUM 9 EACH 1-1/4" FASTENERS AT EACH END FOR RETROFIT CONFIGURATION B
MINIMUM THICKNESS 18 GAUGE FASTENED WITH MINIMUM 12 EACH 1-1/4" FASTENERS AT EACH END FOR RETROFIT CONFIGURATION C
MINIMUM THICKNESS 18 GAUGE FASTENED WITH MINIMUM 8 EACH 1-1/4" FASTENERS AT EACH END OF EACH STRAP FOR RETROFIT CONFIG. D
COMPRESSION BLOCK. MINIMUM 2X4. COMPRESSION BLOCKS ARE PERMITTED TO BE PLACEF OVER STRAPS.
SECURED TO HORIZONTAL BRACE WITH MINIMUM 6 EACH FOR RETROFIT CONFIGURATION A
SECURED TO HORIZONTAL BRACE WITH MINIMUM 8 EACH FOR RETROFIT CONFIGURATION B
SECURED TO HORIZONTAL BRACE WITH MINIMUM 10 EACH FOR RETROFIT CONFIGURATION C
SECURED TO HORIZONTAL BRACE WITH MINIMUM 12 EACH FOR RETROFIT CONFIGURATION D
HORIZONTAL BRACE. MINIMUM 2X4 SECURED TO EACH ATTIC FRAMING MEMBER WITH 3 EACH 3" FASTENERS
1 HORIZONTAL BRACE FOR RETROFIT CONFIGURATIONS A, B, AND C
2 HORIZONTAL BRACES FOR RETROFIT CONFIGURATION D
ATTIC FRAMING MEMBERS
WALL BELOW
FASTENERS SHALL NOT BE PLACED CLOSER TO ENDS OF LUMBER THAN 2-1/2".
FASTENERS SHALL NOT BE PLACED CLOSER TO EDGES OF LUMBER THAN 1/2" EXCEPT WHERE STRAPS DICTATE OTHERWISE.
THE NUMBER OF FASTENERS SHOWN IS NOT NECESSARILY THE NUMBER REQUIRED.
PLAN VIEWS
RETROFIT CONFIGURATIONS A, B, AND C
EXTERIOR WALL
EXISTING STUD
RETROFIT STUD
METAL STRAP
COMPRESSION BLOCK
(CAN BE PLACED OVER STRAP.)
(EACH CAN BUTT EXISTING
STUD.)
ATTIC FRAMING
HORIZONTAL BRACE
RETROFIT CONFIGURATION D
EXTERIOR WALL
EXISTING STUD

For SI: 1 inch = 25.4 mm.

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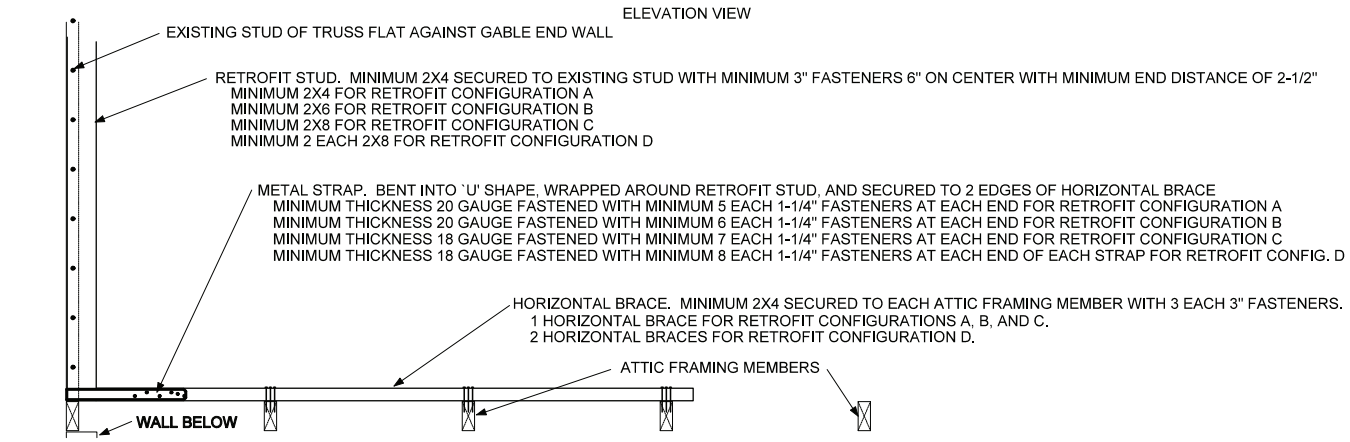
[BS] FIGURE C104.2(3)—TRUSS FRAMED GABLE END U-BENT STRAP


ELEVATION VIEW
EXISTING STUD OF TRUSS FLAT AGAINST GABLE END WALL
RETROFIT STUD. MINIMUM 2X4 SECURED TO EXISTING STUD WITH MINIMUM 3" FASTENERS 6" ON CENTER WITH MINIMUM END DISTANCE OF 2-1/2"
MINIMUM 2X4 FOR RETROFIT CONFIGURATION A
MINIMUM 2X6 FOR RETROFIT CONFIGURATION B
MINIMUM 2X8 FOR RETROFIT CONFIGURATION C
MINIMUM 2 EACH 2X8 FOR RETROFIT CONFIGURATION D
METAL STRAP. BENT INTO `U' SHAPE, WRAPPED AROUND RETROFIT STUD, AND SECURED TO 2 EDGES OF HORIZONTAL BRACE
MINIMUM THICKNESS 20 GAUGE FASTENED WITH MINIMUM 5 EACH 1-1/4" FASTENERS AT EACH END FOR RETROFIT CONFIGURATION A
MINIMUM THICKNESS 20 GAUGE FASTENED WITH MINIMUM 6 EACH 1-1/4" FASTENERS AT EACH END FOR RETROFIT CONFIGURATION B
MINIMUM THICKNESS 18 GAUGE FASTENED WITH MINIMUM 7 EACH 1-1/4" FASTENERS AT EACH END FOR RETROFIT CONFIGURATION C
MINIMUM THICKNESS 18 GAUGE FASTENED WITH MINIMUM 8 EACH 1-1/4" FASTENERS AT EACH END OF EACH STRAP FOR RETROFIT CONFIG. D
HORIZONTAL BRACE. MINIMUM 2X4 SECURED TO EACH ATTIC FRAMING MEMBER WITH 3 EACH 3" FASTENERS.
1 HORIZONTAL BRACE FOR RETROFIT CONFIGURATIONS A, B, AND C.
2 HORIZONTAL BRACES FOR RETROFIT CONFIGURATION D.
ATTIC FRAMING MEMBERS
WALL BELOW
FASTENERS SHALL NOT BE PLACED CLOSER TO ENDS OF LUMBER THAN 2-1/2".
FASTENERS SHALL NOT BE PLACED CLOSER TO EDGES OF LUMBER THAN 1/2" EXCEPT WHERE STRAPS DICTATE OTHERWISE.
THE NUMBER OF FASTENERS SHOWN IS NOT NECESSARILY THE NUMBER REQUIRED.
PLAN VIEWS
RETROFIT CONFIGURATIONS A, B, AND C
EXISTING STUD
EXTERIOR WALL
RETROFIT STUD
METAL STRAP
RETROFIT CONFIGURATION D
ATTIC FRAMING
HORIZONTAL BRACE
EXTERIOR WALL
EXISTING STUD

For SI: 1 inch = 25.4 mm.

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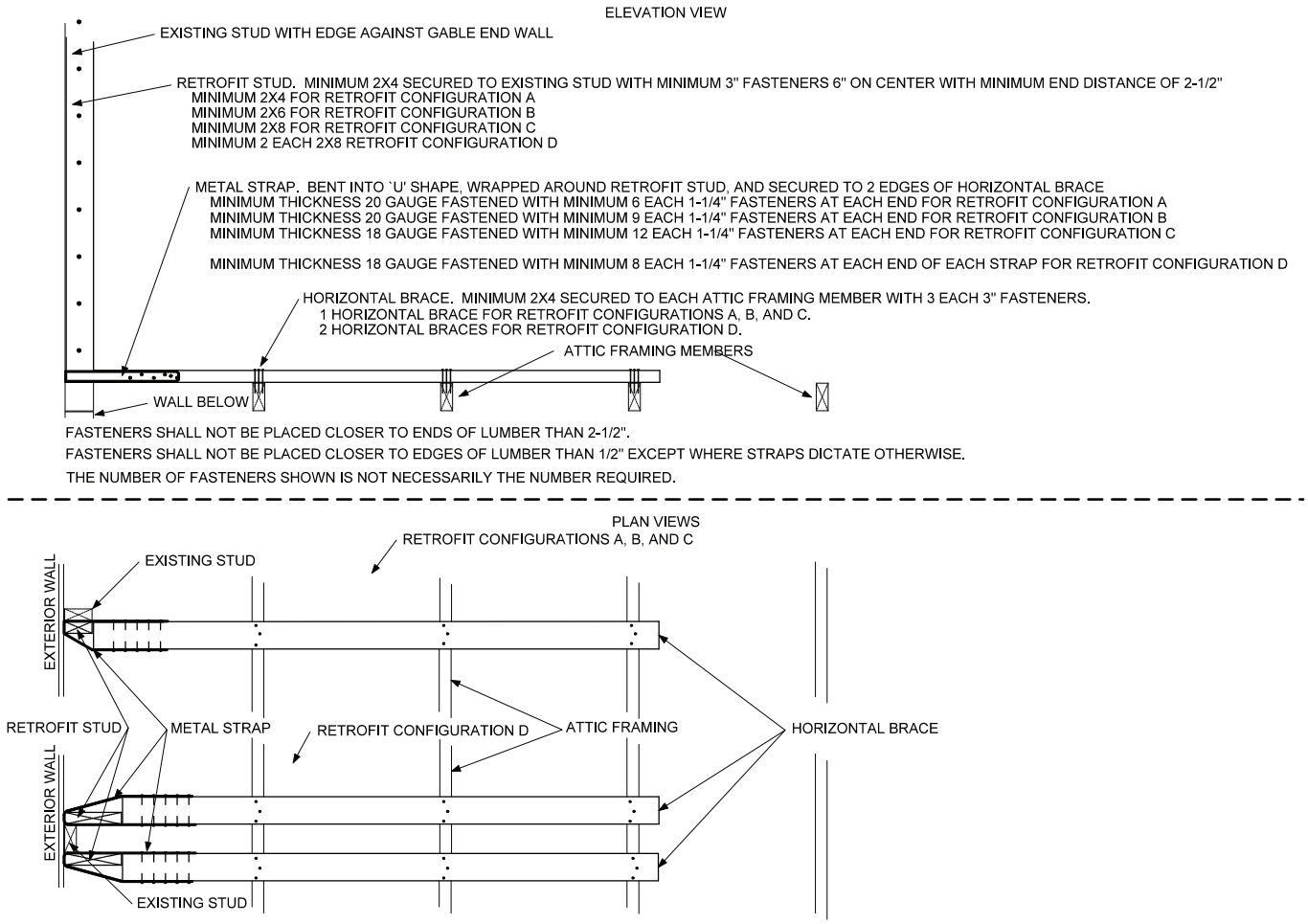
[BS] FIGURE C104.2(4)—CONVENTIONALLY FRAMED GABLE END U-BENT STRAP


ELEVATION VIEW
EXISTING STUD WITH EDGE AGAINST GABLE END WALL
RETROFIT STUD. MINIMUM 2X4 SECURED TO EXISTING STUD WITH MINIMUM 3" FASTENERS 6" ON CENTER WITH MINIMUM END DISTANCE OF 2-1/2"
MINIMUM 2X4 FOR RETROFIT CONFIGURATION A
MINIMUM 2X6 FOR RETROFIT CONFIGURATION B
MINIMUM 2X8 FOR RETROFIT CONFIGURATION C
MINIMUM 2 EACH 2X8 RETROFIT CONFIGURATION D
METAL STRAP. BENT INTO `U' SHAPE, WRAPPED AROUND RETROFIT STUD, AND SECURED TO 2 EDGES OF HORIZONTAL BRACE
MINIMUM THICKNESS 20 GAUGE FASTENED WITH MINIMUM 6 EACH 1-1/4" FASTENERS AT EACH END FOR RETROFIT CONFIGURATION A
MINIMUM THICKNESS 20 GAUGE FASTENED WITH MINIMUM 9 EACH 1-1/4" FASTENERS AT EACH END FOR RETROFIT CONFIGURATION B
MINIMUM THICKNESS 18 GAUGE FASTENED WITH MINIMUM 12 EACH 1-1/4" FASTENERS AT EACH END FOR RETROFIT CONFIGURATION C
MINIMUM THICKNESS 18 GAUGE FASTENED WITH MINIMUM 8 EACH 1-1/4" FASTENERS AT EACH END OF EACH STRAP FOR RETROFIT CONFIGURATION D
HORIZONTAL BRACE. MINIMUM 2X4 SECURED TO EACH ATTIC FRAMING MEMBER WITH 3 EACH 3" FASTENERS.
1 HORIZONTAL BRACE FOR RETROFIT CONFIGURATIONS A, B, AND C.
2 HORIZONTAL BRACES FOR RETROFIT CONFIGURATION D.
ATTIC FRAMING MEMBERS
WALL BELOW
FASTENERS SHALL NOT BE PLACED CLOSER TO ENDS OF LUMBER THAN 2-1/2".
FASTENERS SHALL NOT BE PLACED CLOSER TO EDGES OF LUMBER THAN 1/2" EXCEPT WHERE STRAPS DICTATE OTHERWISE.
THE NUMBER OF FASTENERS SHOWN IS NOT NECESSARILY THE NUMBER REQUIRED.
PLAN VIEWS
RETROFIT CONFIGURATIONS A, B, AND C
EXISTING STUD
EXTERIOR WALL
RETROFIT STUD
METAL STRAP
RETROFIT CONFIGURATION D
ATTIC FRAMING
HORIZONTAL BRACE
EXTERIOR WALL
EXISTING STUD

For SI: 1 inch = 25.4 mm.

[BS] C104.2.1 Existing gable end studs. If the spacing of existing vertical gable end studs is greater than 24 inches (64 mm), a new stud and corresponding horizontal braces shall be installed such that the maximum spacing between existing and added studs shall be not greater than 24 inches (64 mm). Additional gable end wall studs shall not be required at locations where their length would be 3 feet (914 mm) or less. Each end of each required new stud shall be attached to the existing roofing framing members (truss top chord or rafter and truss bottom chord or ceiling joist) using not fewer than two 3-inch (76 mm) toenail fasteners (#8 wood screws or 10d nails) and a metal connector with minimum uplift capacity of 175 pounds (778 N), or nail plates with not fewer than four $1^{1}/_{4}$-inch-long (32 mm) fasteners (No. 8 wood screws or 8d nails).

[BS] C104.2.2 Main method of installation. Each horizontal brace shall be fastened to each existing roof or ceiling member that it crosses using three 3-inch-long (76 mm) fasteners (No. 8 wood screws or 10d nails) as indicated in Figure C104.2(1) and Figure C104.2(3) for trusses and Figure C104.2(2) and Figure C104.2(4) for conventionally framed gable end walls. Alternative methods for providing horizontal bracing of the gable end studs as provided in Sections C104.2.3 through C104.2.9 shall be permitted.

[BS] C104.2.3 Omitted horizontal brace. Where conditions exist that prevent installation in accordance with Section C104.2.2, horizontal braces shall be permitted to be omitted for height limitations corresponding to Retrofit Configurations A and B as defined in Table C104.2 provided that installation is as indicated in Figure C104.2.3 and provided that all of the following conditions are met. This method is not permitted for Retrofit Configurations C or D.

1. There shall be not fewer than two horizontal braces on each side of an omitted horizontal brace or not fewer than one horizontal brace if it is the end horizontal brace. Omitted horizontal braces must be separated by not fewer than two horizontal braces even if that location is composed of two retrofit studs and two horizontal braces.
2. Horizontal braces adjacent to the omitted horizontal brace shall be 2-inch by 6-inch (38 mm by 140 mm) lumber, shall butt against the existing studs, and shall be fastened to each existing roof or ceiling member crossed using three 3-inch-long (76 mm) fasteners (No. 8 wood screws or 10d nails). For Retrofit Configuration B, four fasteners shall be required on not fewer than one of the connections between the horizontal brace and the existing roof and ceiling framing members. Fasteners shall be spaced a not less than $^{3}/_{4}$ inch (19.1 mm) from the edges of the horizontal braces and not less than $1^{3}/_{4}$ inches (44 mm) from adjacent fasteners.
3. Where the existing studs on each side of an omitted horizontal brace have their wide face perpendicular to the gable end wall, the retrofit studs at those locations and the retrofit stud at the omitted horizontal brace locations shall extend not

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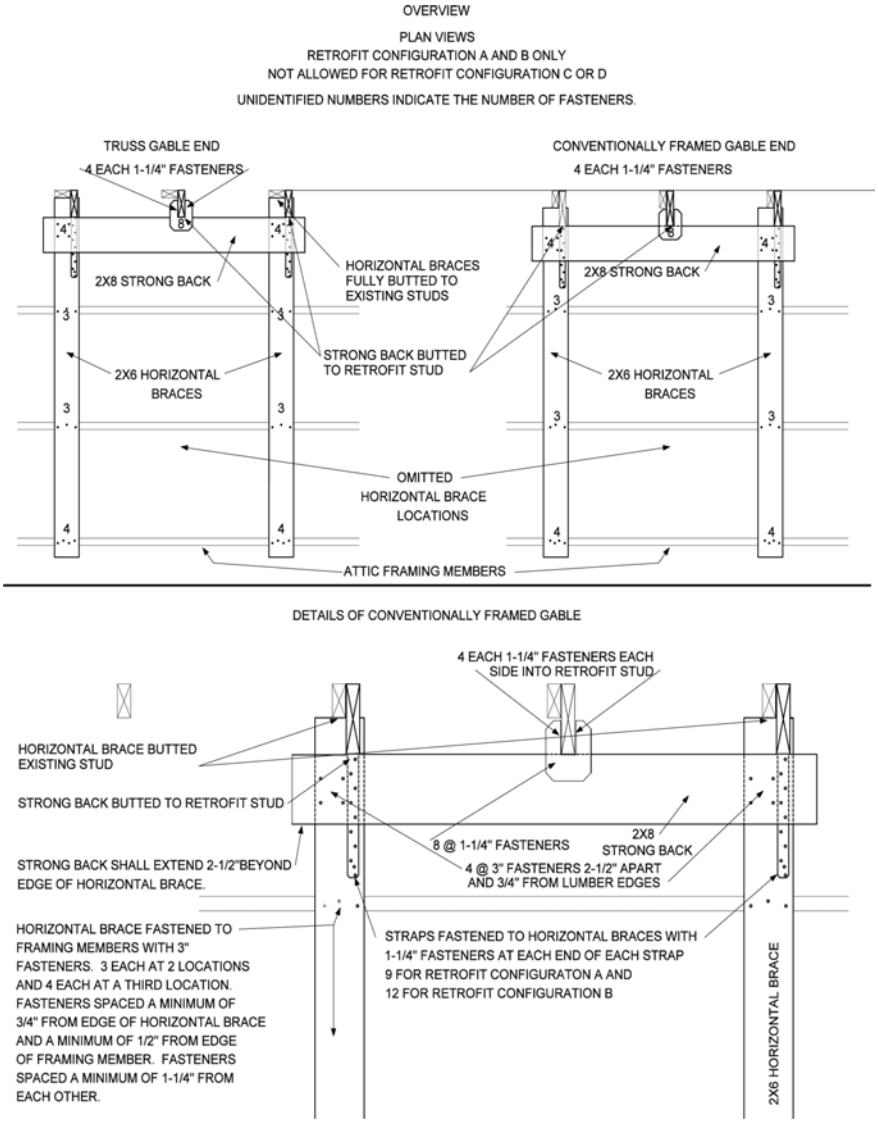
less than $3^3/_4$ inches (95 mm) beyond the interior edge of the existing studs for both Retrofit Configurations A and B. The edges of the three retrofit studs facing towards the interior of the attic shall be aligned such that they are the same distance from the gable end wall.

4. Retrofit studs shall be fastened to existing studs in accordance with Section C104.3.
5. Retrofit studs adjacent to the omitted horizontal brace shall be fastened to the horizontal brace using straps in accordance with Table C104.4.1 consistent with the size of the retrofit stud. The method applicable to Table C104.4.2 is not permitted.
6. A strong back made of minimum of 2-inch by 8-inch (38 mm by 184 mm) nominal lumber shall be placed parallel to the gable end and shall be located on and span between horizontal braces on the two sides of the omitted horizontal brace and shall extend beyond each horizontal brace by not less than $2^1/_2$ inches (64 mm). The strong back shall be butted to the three retrofit studs. The strong back shall be attached to each of the horizontal braces on which it rests with five 3-inch-long (76 mm) fasteners (#8 screws or 8d nails). The fasteners shall have a minimum $^3/_4$-inch (19.1 mm) edge distance and a minimum $2^1/_2$-inch (64 mm) spacing between fasteners. Additional compression blocks shall not be required at locations where a strong back butts against a retrofit stud.
7. The retrofit stud at the location of the omitted horizontal braces shall be fastened to the strong back using a connector with minimum uplift capacity of 800 pounds (3559 N) and installed such that this capacity is oriented in the direction perpendicular to the gable end wall.
8. The use of shortened horizontal braces using the alternative method of Section C104.2.5 is not permitted for horizontal braces adjacent to the omitted horizontal braces.
9. Horizontal braces shall be permitted to be interrupted in accordance with Section C104.2.8.

[BS] FIGURE C104.2.3—OMITTED HORIZONTAL BRACE

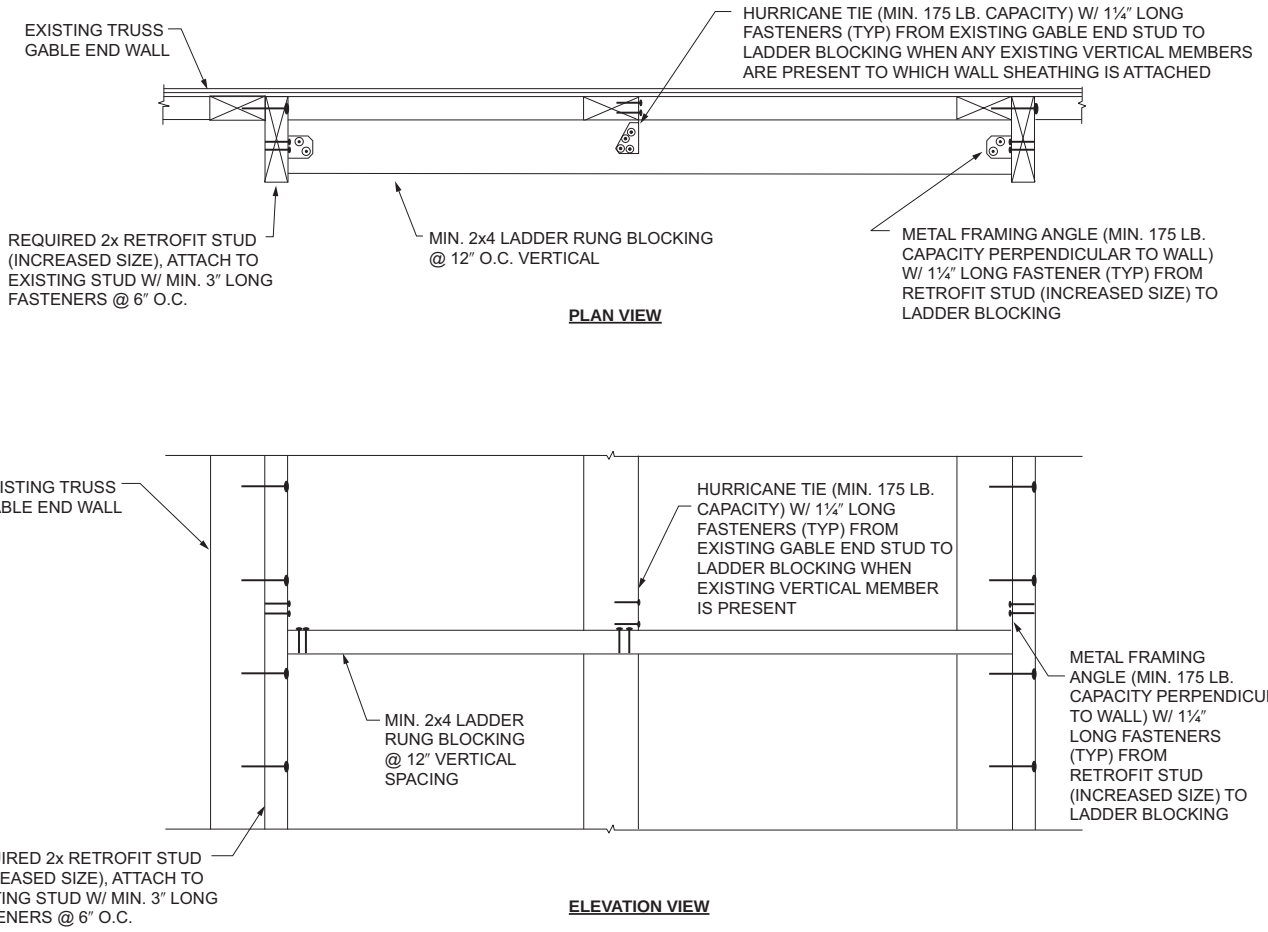

OVERVIEW
PLAN VIEWS
RETROFIT CONFIGURATION A AND B ONLY
NOT ALLOWED FOR RETROFIT CONFIGURATION C OR D
UNIDENTIFIED NUMBERS INDICATE THE NUMBER OF FASTENERS.
TRUSS GABLE END
4 EACH 1-1/4" FASTENERS
CONVENTIONALLY FRAMED GABLE END
4 EACH 1-1/4" FASTENERS
2X8 STRONG BACK
HORIZONTAL BRACES FULLY BUTTED TO EXISTING STUDS
2X8 STRONG BACK
STRONG BACK BUTTED TO RETROFIT STUD
2X6 HORIZONTAL BRACES
2X6 HORIZONTAL BRACES
OMITTED HORIZONTAL BRACE LOCATIONS
ATTIC FRAMING MEMBERS
DETAILS OF CONVENTIONALLY FRAMED GABLE
4 EACH 1-1/4" FASTENERS EACH SIDE INTO RETROFIT STUD
HORIZONTAL BRACE BUTTED EXISTING STUD
STRONG BACK BUTTED TO RETROFIT STUD
8 @ 1-1/4" FASTENERS
2X8 STRONG BACK
4 @ 3" FASTENERS 2-1/2" APART AND 3/4" FROM LUMBER EDGES
STRONG BACK SHALL EXTEND 2-1/2" BEYOND EDGE OF HORIZONTAL BRACE.
HORIZONTAL BRACE FASTENED TO FRAMING MEMBERS WITH 3" FASTENERS. 3 EACH AT 2 LOCATIONS AND 4 EACH AT A THIRD LOCATION. FASTENERS SPACED A MINIMUM OF 3/4" FROM EDGE OF HORIZONTAL BRACE AND A MINIMUM OF 1/2" FROM EDGE OF FRAMING MEMBER. FASTENERS SPACED A MINIMUM OF 1-1/4" FROM EACH OTHER.
STRAPS FASTENED TO HORIZONTAL BRACES WITH 1-1/4" FASTENERS AT EACH END OF EACH STRAP
9 FOR RETROFIT CONFIGURATON A AND
12 FOR RETROFIT CONFIGURATION B
2X6 HORIZONTAL BRACE

For SI: 1 inch = 25.4 mm.

[BS] C104.2.4 Omitted horizontal brace and retrofit stud. Where conditions exist that prevent installation in accordance with Section C104.2.2 or C104.2.3, then retrofit studs and horizontal braces shall be permitted to be omitted from those locations by installation of ladder assemblies for Retrofit Configurations A and B as defined in Table C104.2 provided that all of the following conditions are met. This method is not permitted for Retrofit Configurations C or D.

1. Not more than two ladder assemblies are permitted on a single gable end.
2. There shall be not fewer than two retrofit studs and horizontal brace assemblies on either side of the locations where the retrofit studs and horizontal bracing members are omitted (two ladder braces shall not bear on a single retrofit stud).
3. Where the existing studs on each side of an omitted horizontal brace have their wide face parallel to the gable end wall the retrofit studs at those locations and the retrofit stud at the omitted horizontal brace locations shall be 2-inch by 6-inch (38 mm by 180 mm) nominal lumber for Retrofit Configuration A and 2-inch by 8-inch (38 mm by 184 mm) lumber for Retrofit Configuration B.
4. Horizontal braces adjacent to the omitted horizontal brace shall be 2-inch by 6-inch (38 mm by 180 mm) nominal lumber and be fastened to each existing roof or ceiling member crossed using three 3-inch long (76 mm) fasteners (#8 wood screws or 10d nails) as indicated in Figures C104.2(1) and C104.2(3) for gable end frames and Figures C104.2(2) and C104.2(4) for conventionally framed gable end walls. For Retrofit Configuration B, four fasteners shall be required on one of the connections between the horizontal brace and the existing roof and ceiling framing members.
5. Ladder rungs shall be provided across the location of the omitted retrofit studs as indicated in Figure C104.2.4(1) for gable end frames and Figure C104.2.4(2) for conventionally framed gable end walls.
6. Ladder rungs shall be minimum 2-inch by 4-inch (38 mm by 89 mm) lumber oriented with their wide face horizontal and spaced not greater than 16 inches (406 mm) on center vertically.
7. Where ladder rungs cross wall framing members they shall be connected to the wall framing members with a metal connector with a minimum capacity of 175 pounds (778 N) in the direction perpendicular to the gable end wall.
8. Notching of the ladder rungs shall not be permitted unless the net depth of the framing member is not less than $3^1/_2$ inches (89 mm).

[BS] FIGURE C104.2.4(1)—LADDER BRACING FOR OMITTED RETROFIT STUD (GABLE END FRAME)


EXISTING TRUSS GABLE END WALL
HURRICANE TIE (MIN. 175 LB. CAPACITY) W/ 1¼″ LONG FASTENERS (TYP) FROM EXISTING GABLE END STUD TO LADDER BLOCKING WHEN ANY EXISTING VERTICAL MEMBERS ARE PRESENT TO WHICH WALL SHEATHING IS ATTACHED
REQUIRED 2x RETROFIT STUD (INCREASED SIZE), ATTACH TO EXISTING STUD W/ MIN. 3″ LONG FASTENERS @ 6″ O.C.
MIN. 2x4 LADDER RUNG BLOCKING @ 12″ O.C. VERTICAL
METAL FRAMING ANGLE (MIN. 175 LB. CAPACITY PERPENDICULAR TO WALL) W/ 1¼″ LONG FASTENER (TYP) FROM RETROFIT STUD (INCREASED SIZE) TO LADDER BLOCKING
PLAN VIEW
EXISTING TRUSS GABLE END WALL
HURRICANE TIE (MIN. 175 LB. CAPACITY) W/ 1¼″ LONG FASTENERS (TYP) FROM EXISTING GABLE END STUD TO LADDER BLOCKING WHEN EXISTING VERTICAL MEMBER IS PRESENT
MIN. 2x4 LADDER RUNG BLOCKING @ 12″ VERTICAL SPACING
METAL FRAMING ANGLE (MIN. 175 LB. CAPACITY PERPENDICULAR TO WALL) W/ 1¼″ LONG FASTENERS (TYP) FROM RETROFIT STUD (INCREASED SIZE) TO LADDER BLOCKING
REQUIRED 2x RETROFIT STUD (INCREASED SIZE), ATTACH TO EXISTING STUD W/ MIN. 3″ LONG FASTENERS @ 6″ O.C.
ELEVATION VIEW

For SI: 1 inch = 25.4 mm, 1 pound = 4.4 N.

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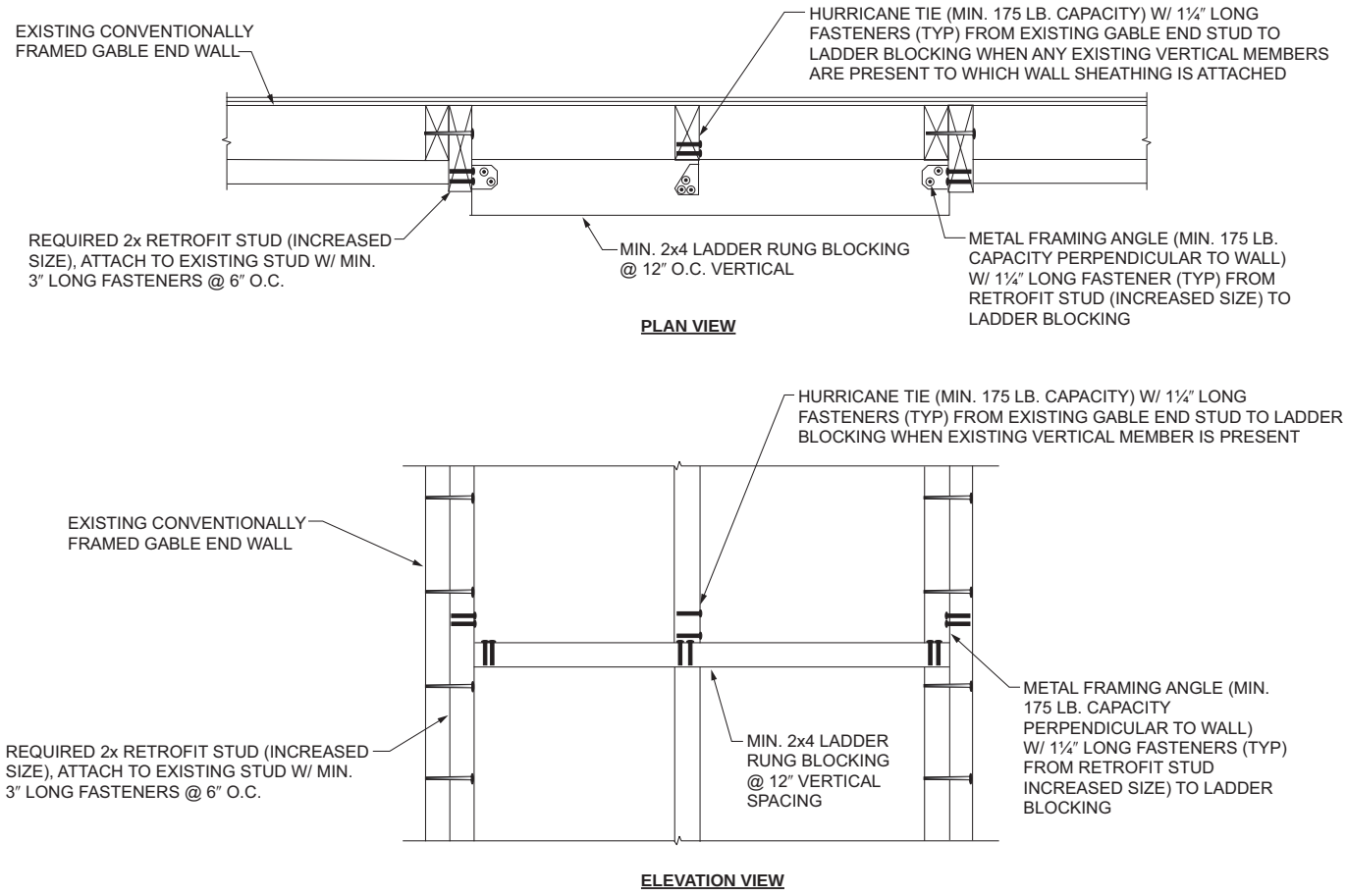
[BS] FIGURE C104.2.4(2)—LADDER BRACING FOR OMITTED RETROFIT STUD (CONVENTIONALLY FRAMED GABLE END)

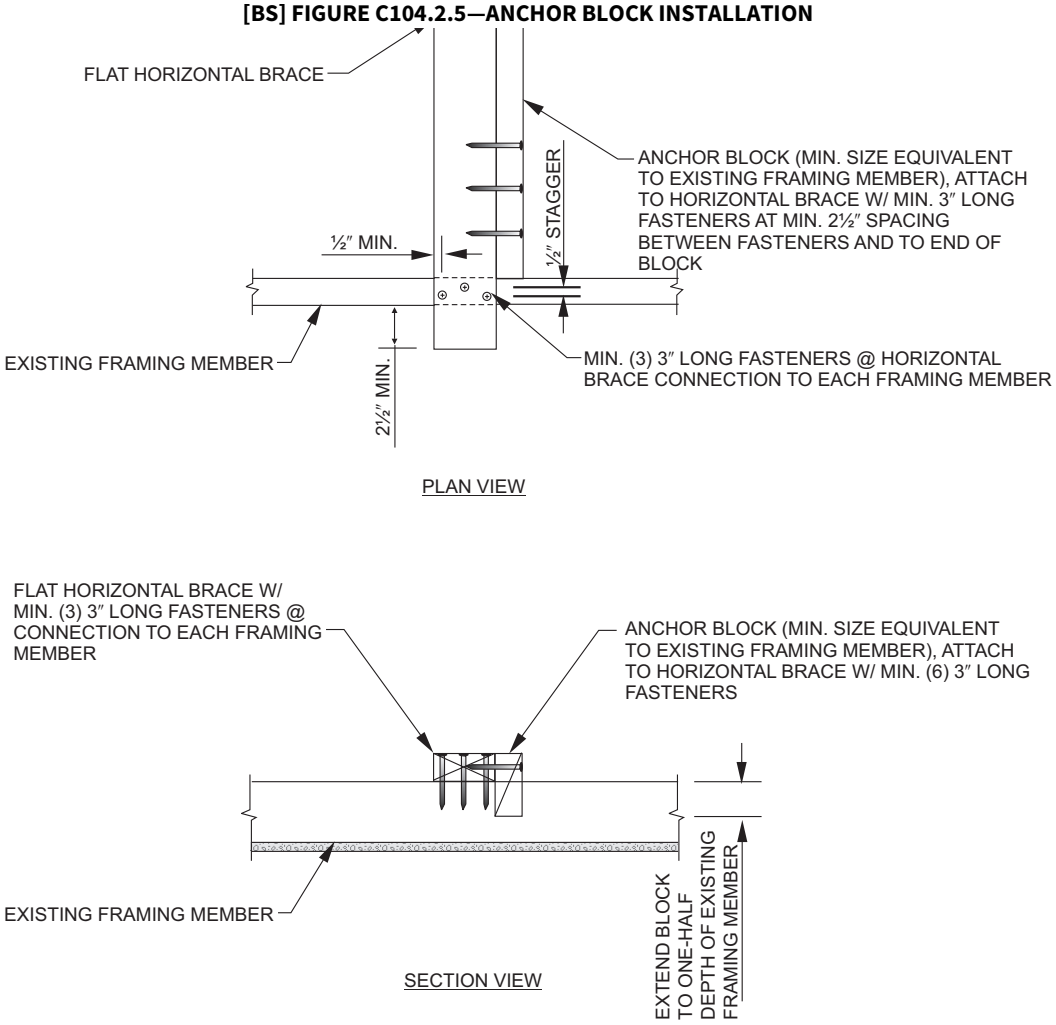

EXISTING CONVENTIONALLY FRAMED GABLE END WALL
HURRICANE TIE (MIN. 175 LB. CAPACITY) W/ 1¼″ LONG FASTENERS (TYP) FROM EXISTING GABLE END STUD TO LADDER BLOCKING WHEN ANY EXISTING VERTICAL MEMBERS ARE PRESENT TO WHICH WALL SHEATHING IS ATTACHED
REQUIRED 2x RETROFIT STUD (INCREASED SIZE), ATTACH TO EXISTING STUD W/ MIN. 3″ LONG FASTENERS @ 6″ O.C.
MIN. 2x4 LADDER RUNG BLOCKING @ 12″ O.C. VERTICAL
METAL FRAMING ANGLE (MIN. 175 LB. CAPACITY PERPENDICULAR TO WALL) W/ 1¼″ LONG FASTENER (TYP) FROM RETROFIT STUD (INCREASED SIZE) TO LADDER BLOCKING
PLAN VIEW
HURRICANE TIE (MIN. 175 LB. CAPACITY) W/ 1¼″ LONG FASTENERS (TYP) FROM EXISTING GABLE END STUD TO LADDER BLOCKING WHEN EXISTING VERTICAL MEMBER IS PRESENT
EXISTING CONVENTIONALLY FRAMED GABLE END WALL
REQUIRED 2x RETROFIT STUD (INCREASED SIZE), ATTACH TO EXISTING STUD W/ MIN. 3″ LONG FASTENERS @ 6″ O.C.
MIN. 2x4 LADDER RUNG BLOCKING @ 12″ VERTICAL SPACING
METAL FRAMING ANGLE (MIN. 175 LB. CAPACITY PERPENDICULAR TO WALL) W/ 1¼″ LONG FASTENERS (TYP) FROM RETROFIT STUD INCREASED SIZE) TO LADDER BLOCKING
ELEVATION VIEW

For SI: 1 inch = 25.4 mm, 1 pound = 4.4 N.

[BS] C104.2.5 Short horizontal brace. Where conditions exist that prevent installation in accordance with Section C104.2.2, C104.2.3 or C104.2.4, the horizontal braces shall be permitted to be shortened provided that installation is as indicated in Figure C104.2.5 and all of the following conditions are met.

1. The horizontal brace shall be installed across not fewer than two framing spaces, extend not less than 4 feet (1220 mm) from the gable end wall plus $2^1/_2$ inches (64 mm) beyond the farthest roof or ceiling framing member from the gable end, and be fastened to each existing framing member with three 3-inch-long (76 mm) fasteners (#8 wood screws or 10d nails).
2. An anchor block shall be fastened to the side of the horizontal brace in the second framing space from the gable end wall as shown in Figure C104.2.5. The anchor block lumber shall have a minimum edge thickness of $1^1/_2$ inches (38 mm) and the depth shall be at a minimum the depth of the existing roof or ceiling framing member. Six 3-inch-long (76 mm) fasteners (#8 wood screws or 10d nails) shall be used to fasten the anchor block to the side of the horizontal brace.
3. The anchor block shall extend into the space between the roof or ceiling framing members not less than one-half the depth of the existing-framing members at the location where the anchor block is installed. The anchor block shall be installed tightly between the existing framing members such that the gap at either end shall not exceed $^1/_8$ inch (3.2 mm).
4. The use of omitted horizontal braces using the method of Section C104.2.3 adjacent to a short horizontal brace as defined in this section is not permitted.

[BS] FIGURE C104.2.5—ANCHOR BLOCK INSTALLATION


FLAT HORIZONTAL BRACE
ANCHOR BLOCK (MIN. SIZE EQUIVALENT TO EXISTING FRAMING MEMBER), ATTACH TO HORIZONTAL BRACE W/ MIN. 3″ LONG FASTENERS AT MIN. 2½″ SPACING BETWEEN FASTENERS AND TO END OF BLOCK
½″ STAGGER
½″ MIN.
EXISTING FRAMING MEMBER
2½″ MIN.
MIN. (3) 3″ LONG FASTENERS @ HORIZONTAL BRACE CONNECTION TO EACH FRAMING MEMBER
PLAN VIEW
FLAT HORIZONTAL BRACE W/ MIN. (3) 3″ LONG FASTENERS @ CONNECTION TO EACH FRAMING MEMBER
ANCHOR BLOCK (MIN. SIZE EQUIVALENT TO EXISTING FRAMING MEMBER), ATTACH TO HORIZONTAL BRACE W/ MIN. (6) 3″ LONG FASTENERS
EXISTING FRAMING MEMBER
EXTEND BLOCK TO ONE-HALF DEPTH OF EXISTING FRAMING MEMBER
SECTION VIEW

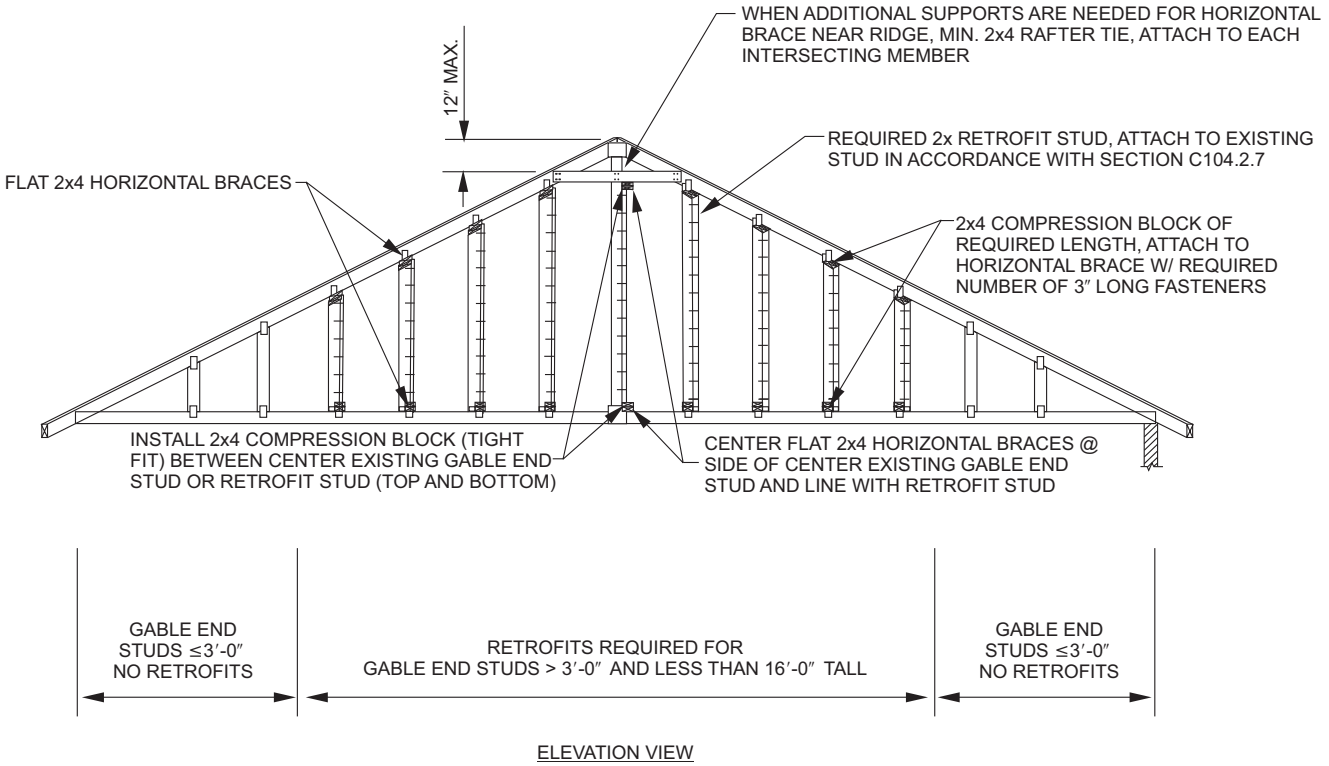
For SI: 1 inch = 25.4 mm.

[BS] C104.2.6 Installation of horizontal braces onto webs of trusses. Where existing conditions preclude installation of horizontal braces on truss top or bottom chords they shall be permitted to be installed on truss webs provided that all of the following conditions are met:

1. Horizontal braces shall be installed as close to the top or bottom chords as practical without altering the truss or any of its components and not more than three times the depth of the truss member to which it would ordinarily be attached.
2. A racking block, comprised of an anchor block meeting the definition of "Anchor block" in Section C102 or comprised of minimum $^{15}/_{32}$-inch (12 mm) plywood or $^{7}/_{16}$-inch (11.1 mm) oriented strand board (OSB), shall be fastened to the horizontal brace in the second framing space from the gable end wall. The racking block shall extend toward the roof or ceiling diaphragm so that the edge of the racking block closest to the diaphragm is within one-half the depth of the existing framing member from the diaphragm surface. The racking block shall be attached to horizontal braces using six fasteners (No. 8 wood screws or 10d nails) of sufficient length to provide $1^{1}/_{2}$ inches (38 mm) of penetration into the horizontal brace.
3. Racking blocks shall be permitted to be fastened to any face or edge of horizontal braces between each web or truss vertical posts to which a horizontal brace is attached. Racking blocks shall be permitted to be on alternate sides of horizontal braces. Racking blocks shall be installed tightly between the lumber of truss members or truss plates such that the gap at either end shall be not greater than $^{1}/_{8}$ inch (3.2 mm).

[BS] C104.2.7 Alternative method of installation of horizontal braces at truss ridges. Where conditions exist that limit or restrict installation of horizontal braces near the peak of the roof, ridge ties shall be added to provide support for the required horizontal brace. The top of additional ridge tie members shall be installed not greater than 16 inches (406 mm) below the existing ridge line or 4 inches (102 mm) below impediments. A minimum 2-inch by 4-inch (38 mm by 89 mm) nominal member shall be used for each ridge tie, and fastening shall consist of two 3-inch-long (76 mm) wood screws, four 3-inch-long (76 mm) 10d nails or two $3^{1}/_{2}$-inch-long (89 mm) 16d nails driven through and clinched at each top chord or web member intersected by the ridge tie as illustrated in Figure C104.2.7.

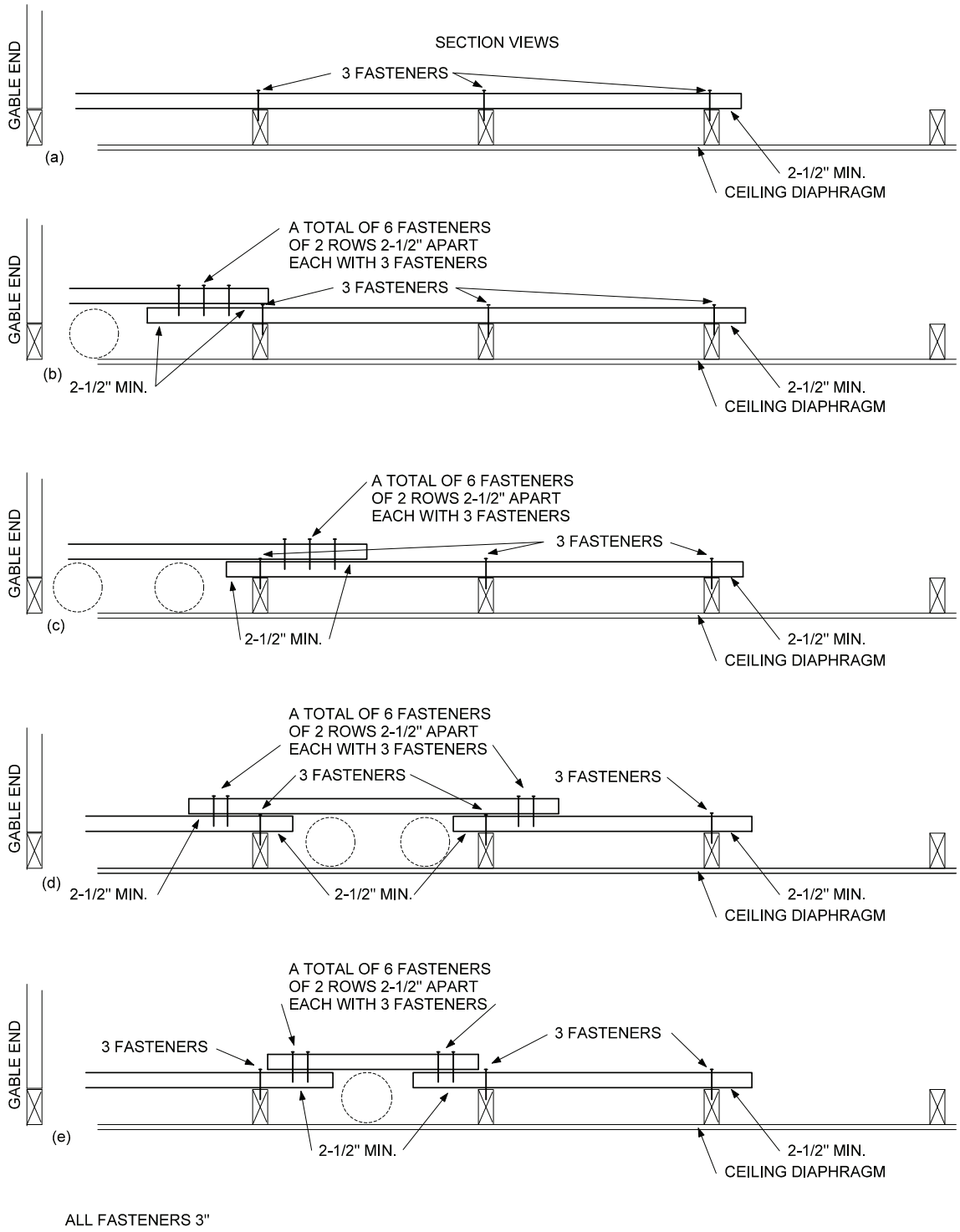
[BS] FIGURE C104.2.7—DETAIL OF RETROFIT TIE INSTALLATION


WHEN ADDITIONAL SUPPORTS ARE NEEDED FOR HORIZONTAL BRACE NEAR RIDGE, MIN. 2x4 RAFTER TIE, ATTACH TO EACH INTERSECTING MEMBER
12″ MAX.
REQUIRED 2x RETROFIT STUD, ATTACH TO EXISTING STUD IN ACCORDANCE WITH SECTION C104.2.7
FLAT 2x4 HORIZONTAL BRACES
2x4 COMPRESSION BLOCK OF REQUIRED LENGTH, ATTACH TO HORIZONTAL BRACE W/ REQUIRED NUMBER OF 3″ LONG FASTENERS
INSTALL 2x4 COMPRESSION BLOCK (TIGHT FIT) BETWEEN CENTER EXISTING GABLE END STUD OR RETROFIT STUD (TOP AND BOTTOM)
CENTER FLAT 2x4 HORIZONTAL BRACES @ SIDE OF CENTER EXISTING GABLE END STUD AND LINE WITH RETROFIT STUD
GABLE END STUDS ≤3′-0″ NO RETROFITS
RETROFITS REQUIRED FOR GABLE END STUDS > 3′-0″ AND LESS THAN 16′-0″ TALL
GABLE END STUDS ≤3′-0″ NO RETROFITS
ELEVATION VIEW

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

[BS] C104.2.8 Interrupted horizontal braces. Where conditions exist that prevent the installation of a continuous horizontal brace then horizontal braces shall be permitted to be interrupted using the methods shown in Figures C104.2.8(1), C104.2.8(2), and C104.2.8(3). For interruptions that occur in the attic framing space closest to the gable end, nine 3-inch (76 mm) fasteners shall be used to connect each section of the interrupted horizontal braces. For interruptions that occur in the second attic space from the gable end, six 3-inch (76 mm) fasteners shall be used to connect each section of the interrupted horizontal braces. For interruptions that occur in the attic framing space farthest from the gable end, three 3-inch (76 mm) fasteners shall be used to connect each section of the interrupted horizontal braces. Horizontal braces shall be continued far enough to allow connections to three existing roof framing members as shown in Figure C104.2.8(1), C104.2.8(2) or C104.2.8(3). Fasteners shall be spaced in accordance with Section C103.5.3. Horizontal braces shall be the same width and depth as required for an uninterrupted member.

[BS] FIGURE C104.2.8(1)—SPLICED HORIZONTAL BRACES



For SI: 1 inch = 25.4 mm.

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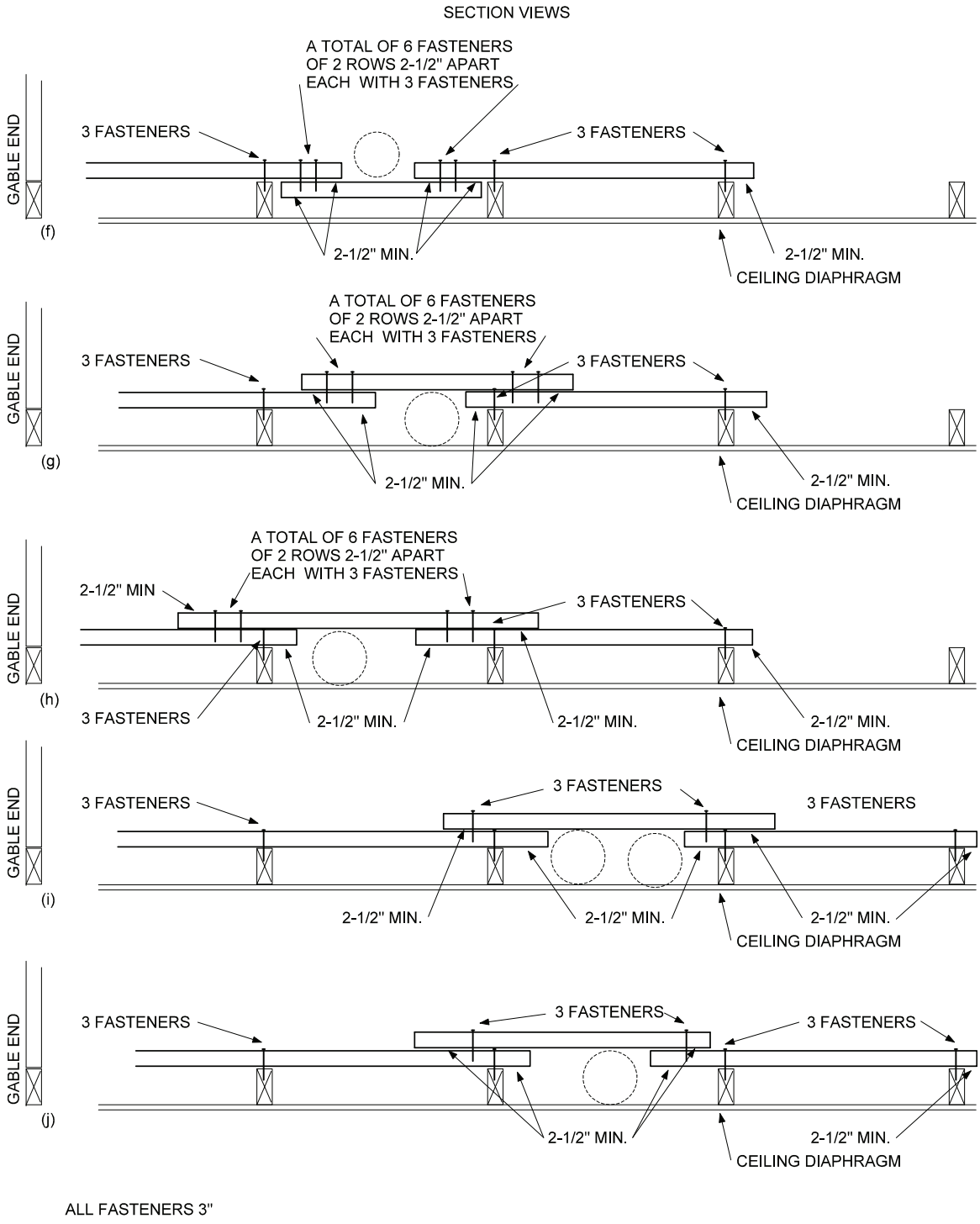
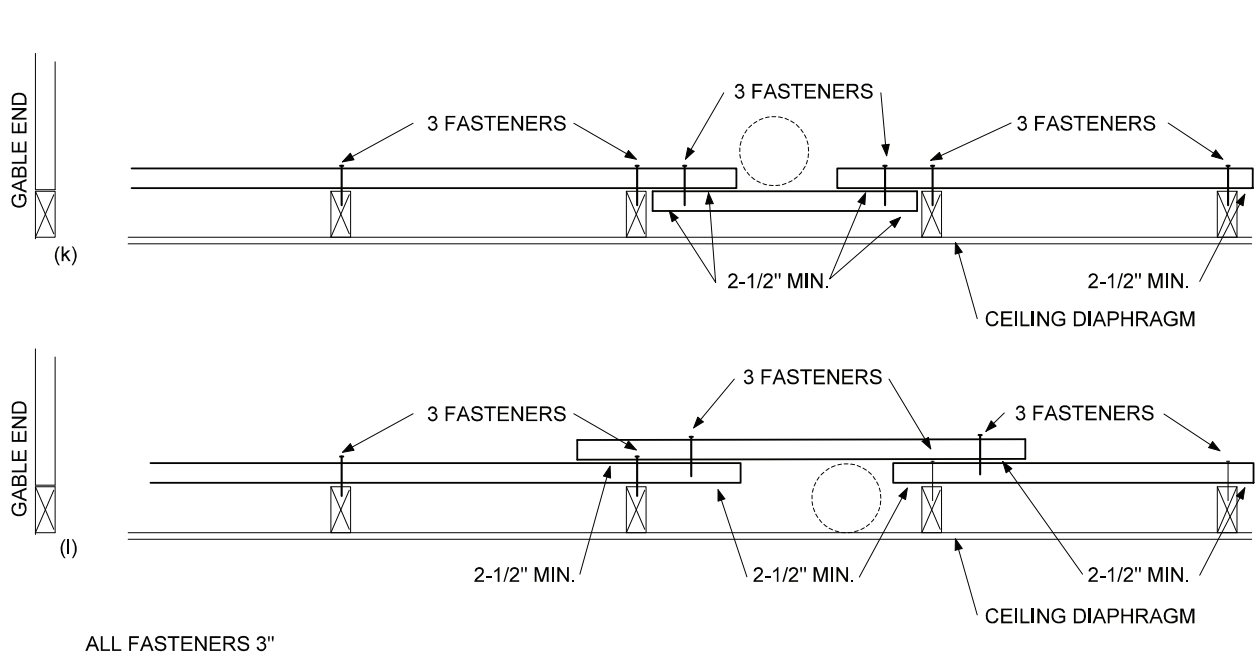
[BS] FIGURE C104.2.8(2)—SPLICED HORIZONTAL BRACES



For SI: 1 inch = 25.4 mm.

[BS] FIGURE C104.2.8(3)—SPLICED HORIZONTAL BRACES



For SI: 1 inch = 25.4 mm.

[BS] C104.2.9 Piggyback gable end frames. Piggyback gable end frames (gable end frames built in two sections one above the other) shall be permitted to be retrofitted if either of the following cases is true:

1. The existing studs in both the upper gable end frames and the lower gable end frames to which wall sheathing, panel siding, or other wall covering are attached are sufficiently in line that retrofit studs can be installed and connections made between the two with retrofit stud(s).
2. Existing studs in the upper frame are not sufficiently in line with the studs in the frame below and the existing studs in the upper frame are 3 feet (91 cm) or shorter.

For Condition 1, both the lower stud and the upper stud shall be retrofitted using the methods of Section C104.2. For Condition 2, the retrofit stud shall be connected to the lower studs using the methods of Section C104.2 and be continuous from the bottom horizontal brace to the top horizontal brace. Connection is not required between the retrofit stud and the upper stud. In both conditions the bottom chord of the piggyback truss section shall be fastened to each retrofit stud using a connector with minimum axial capacity of 175 pounds (778 N).

[BS] C104.3 Retrofit studs. Retrofit studs shall be installed in accordance with Section C104.3.1 using one of the five methods of Section C104.3.2, C104.3.3, C104.3.4, C104.3.5 or C104.3.6. Figure C104.3 shows these methods of installation. For the Retrofit Configuration obtained from Table C104.2, the size of retrofit studs shall be as indicated in Table C104.4.1 or Table C104.4.2. Retrofit studs shall extend from the top of the lower horizontal brace to the bottom of the upper horizontal brace except that a maximum gap of $^1/_8$ inch (3.2 mm) is permitted at the bottom and $^1/_2$ inch (12.7 mm) at the top. Where wall sheathing, panel siding or other wall covering is fastened to a conventionally framed gable end, retrofit studs shall be applied in accordance with Section C104.2.1.

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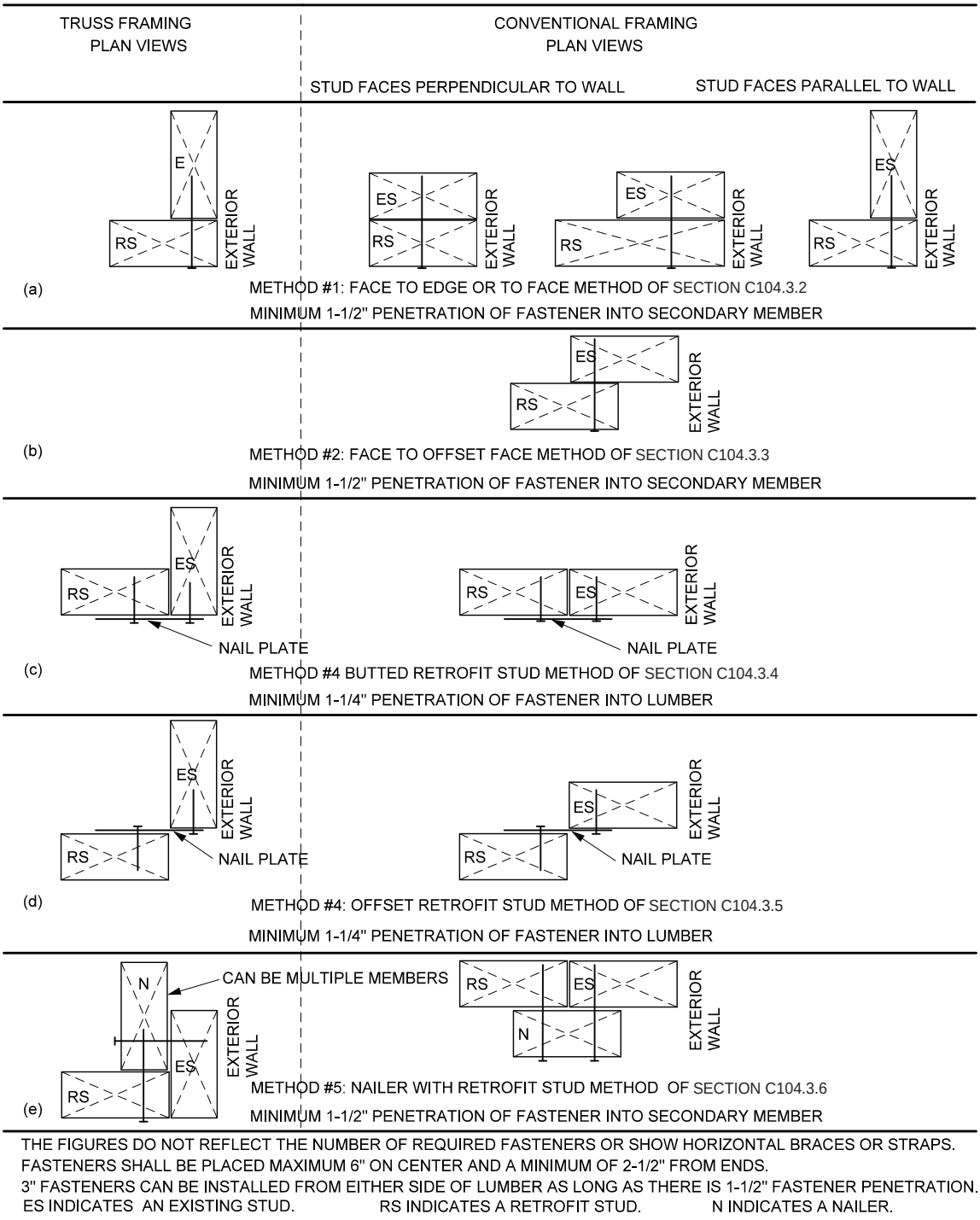
[BS] FIGURE C104.3—METHOD OF INSTALLING RETROFIT STUDS



For SI: 1 inch = 25.4 mm.

[BS] C104.3.1 Fastening. Where nail plates are not used, retrofit studs shall be attached to existing studs using 3-inch (76 mm) fasteners at not greater than 6 inches (152 mm) on center but not closer than $2^1/_2$ inches (64 mm) on center with fasteners not closer to ends of members than $2^1/_2$ inches (64 mm).

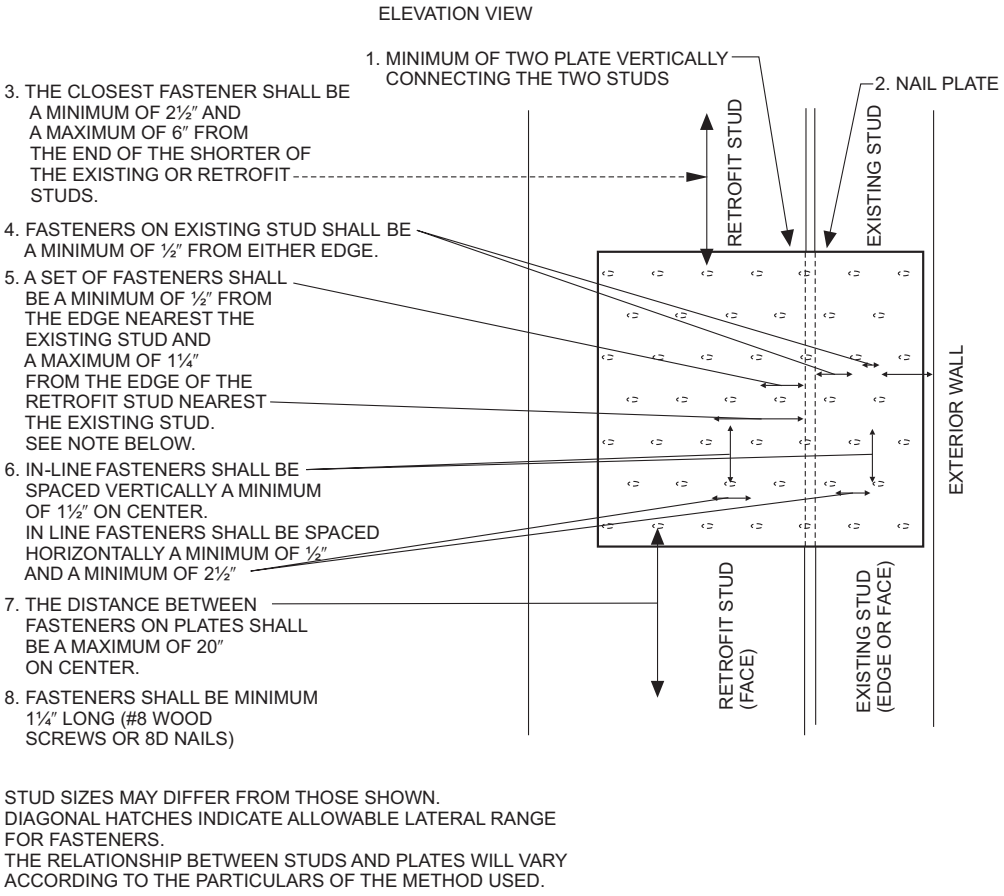
[BS] C104.3.2 Method #1: Face-to-edge or face-to-face method. Retrofit studs shall be installed immediately adjacent to existing gable end wall studs as indicated in Figure C104.3(a). The retrofit studs shall overlap the edge or side of the existing stud by not less than $1^1/_4$ inches (32 mm). Fasteners shall be installed as specified in Section C104.3.1.

[BS] C104.3.3 Method #2: Face-to-face offset method. Retrofit studs shall be installed against the face of existing studs as indicated in Figure C104.3(b) such that the faces overlap not less than $1^1/_2$ inches (38 mm) and the edge distance to fasteners is not less than $^3/_4$ inch (19.1 mm). Fasteners shall be installed as specified in Section C104.3.1.

[BS] C104.3.4 Method #3: Butted retrofit stud method. Provided that all of the following fastening conditions are met, retrofit studs shall be permitted to be butted by their edge to existing studs with the addition of nail plates as indicated in Figure C104.3(c) and Figure C104.3.4.

1. The narrow edge of retrofit studs shall be installed against the narrow or the wide face of existing studs.
2. Not fewer than two nail plates shall be used.
3. Fasteners used to secure nail plates to studs shall be a minimum $1^1/_4$ inches (32 mm) long (#8 wood screws or 8d nails).
4. Fasteners placed in nail plates shall have a minimum end distance of $2^1/_2$ inches (64 mm) for both studs and a maximum end distance of 6 inches (152 mm) from the ends of the shorter stud.
5. Fasteners shall have a minimum $^1/_2$-inch (12.7 mm) edge distance. Fasteners shall be placed not greater than $1^1/_2$ inches (38 mm) from the abutting vertical edges of existing studs and retrofit studs.
6. There shall be at least three fasteners through nail plates into all existing and retrofit studs to which the nail plate is attached.
7. Nail plates with three fasteners onto a single existing or retrofit stud shall be spaced not greater than 15 inches (38 cm) on center.
8. Nail plates with more than three fasteners onto a single existing or retrofit stud shall be spaced not greater than 20 inches (51 cm) on center.
9. Fasteners used to secure nail plates shall be spaced vertically not less than $1^1/_2$ inches (38 mm) on center. Staggered fasteners used to secure nail plates shall be spaced horizontally not less than $^1/_2$ inch (12.7 mm).

[BS] FIGURE C104.3.4—NAIL PLATE FASTENING


ELEVATION VIEW
1. MINIMUM OF TWO PLATE VERTICALLY CONNECTING THE TWO STUDS
2. NAIL PLATE
3. THE CLOSEST FASTENER SHALL BE A MINIMUM OF 2½″ AND A MAXIMUM OF 6″ FROM THE END OF THE SHORTER OF THE EXISTING OR RETROFIT STUDS.
4. FASTENERS ON EXISTING STUD SHALL BE A MINIMUM OF ½″ FROM EITHER EDGE.
5. A SET OF FASTENERS SHALL BE A MINIMUM OF ½″ FROM THE EDGE NEAREST THE EXISTING STUD AND A MAXIMUM OF 1¼″ FROM THE EDGE OF THE RETROFIT STUD NEAREST THE EXISTING STUD. SEE NOTE BELOW.
6. IN-LINE FASTENERS SHALL BE SPACED VERTICALLY A MINIMUM OF 1½″ ON CENTER. IN LINE FASTENERS SHALL BE SPACED HORIZONTALLY A MINIMUM OF ½″ AND A MINIMUM OF 2½″
7. THE DISTANCE BETWEEN FASTENERS ON PLATES SHALL BE A MAXIMUM OF 20″ ON CENTER.
8. FASTENERS SHALL BE MINIMUM 1¼″ LONG (#8 WOOD SCREWS OR 8D NAILS)
RETROFIT STUD
EXISTING STUD
EXTERIOR WALL
RETROFIT STUD (FACE)
EXISTING STUD (EDGE OR FACE)
STUD SIZES MAY DIFFER FROM THOSE SHOWN.
DIAGONAL HATCHES INDICATE ALLOWABLE LATERAL RANGE FOR FASTENERS.
THE RELATIONSHIP BETWEEN STUDS AND PLATES WILL VARY ACCORDING TO THE PARTICULARS OF THE METHOD USED.

For SI: 1 inch = 25.4 mm.

[BS] C104.3.5 Method #4: Offset retrofit stud method. Retrofit studs may be offset from existing studs by use of nail plates as shown in Figure C104.3(d) such that the vertical corner of a retrofit stud shall align with the vertical corner of an existing stud as indicated in Figure C104.3(d) and Figure C104.3.4, and the fastening conditions of Section C104.3.4 are met.

[BS] C104.3.6 Method #5: Nailer with retrofit stud method. Retrofit studs and existing studs shall be permitted to be connected using noncontinuous 2-inch by 4-inch (38 mm by 89 mm) nailers as indicated in Figure C104.3(e) provided that the following conditions are met.

1. Both the existing stud and the retrofit stud shall be butted to nailers and both shall be fastened to the nailer with 3-inch-long (76 mm) fasteners (#8 wood screws or 8d nails). Fasteners connecting each stud to the nailer shall be a spaced 6 inches (152 mm) o.c.

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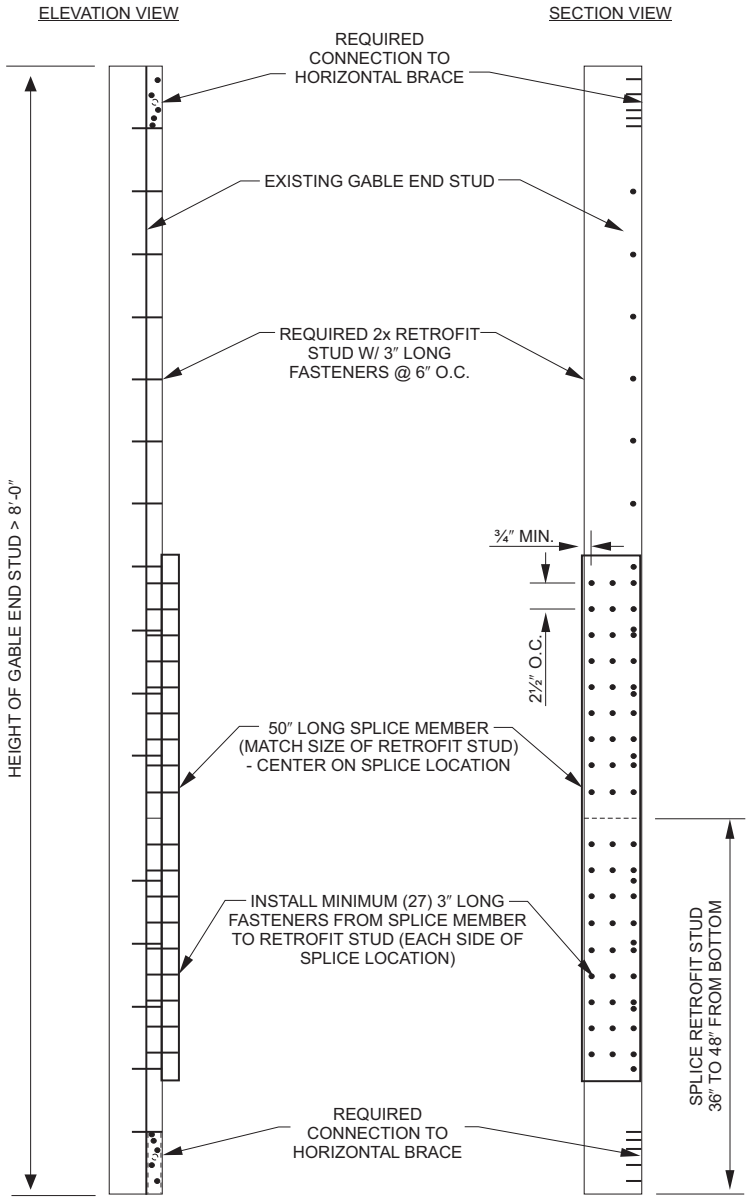
2. Fasteners into nailers from any direction shall be offset vertically by not less than $2^1/_2$ inches (64 mm).
3. Fasteners into nailers shall be not less than $2^1/_2$ inches (64 mm) but not more than 6 inches (152 mm) from the end of the shorter of the existing stud and retrofit stud to which they are fastened.

[BS] C104.3.7 Reduced depth of retrofit studs. Retrofit studs may be reduced in depth by notching, tapering or other methods at any number of locations along their length provided that all of the following conditions are met:

1. Retrofit studs to be reduced in depth shall be sized such that the remaining minimum depth of member at the location of the notch (including cross-cut kerfs) shall be not less than that required by Table C104.4.1 or Table C104.4.2.
2. Reduced in-depth retrofit stud shall not be spliced within 12 inches (30 cm) of the location of notches. Splice members shall not be notched.
3. The vertical extent of notches shall not exceed 12 inches (30 cm) as measured at the depth of location of reduced depth.
4. A reduced in-depth retrofit stud member shall be fastened to the side of the existing gable end wall studs in accordance with Section C104.3.1. Two additional 3-inch (76 mm) fasteners (#8 wood screws or 10d nails) shall be installed on each side of notches in addition to those required by Section C104.3.1.

[BS] C104.3.8 Retrofit stud splices. Retrofit studs greater than 8 feet (244 cm) in height may be field spliced in accordance with Figure C104.3.8.

[BS] FIGURE C104.3.8—RETROFIT STUD SPLICES


ELEVATION VIEW
SECTION VIEW
REQUIRED CONNECTION TO HORIZONTAL BRACE
EXISTING GABLE END STUD
REQUIRED 2x RETROFIT STUD W/ 3″ LONG FASTENERS @ 6″ O.C.
¾″ MIN.
2½″ O.C.
50″ LONG SPLICE MEMBER (MATCH SIZE OF RETROFIT STUD) - CENTER ON SPLICE LOCATION
INSTALL MINIMUM (27) 3″ LONG FASTENERS FROM SPLICE MEMBER TO RETROFIT STUD (EACH SIDE OF SPLICE LOCATION)
REQUIRED CONNECTION TO HORIZONTAL BRACE
HEIGHT OF GABLE END STUD > 8′-0″
SPLICE RETROFIT STUD 36″ TO 48″ FROM BOTTOM

NOTE:
SPLICE LOCATION MAY BE REQUIRED AT TOP OF GABLE END STUD IF HEIGHT > 11′-0″ TO 12′-0″

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

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[BS] C104.4 Connection between horizontal braces and retrofit studs. Connections between horizontal braces and retrofit studs shall comply with Section C104.4.1 or C104.4.2. Each retrofit stud shall be connected to the top and bottom horizontal brace members with a minimum 20-gage $1^1/_4$-inch-wide (32 mm) flat or coil metal strap with prepunched holes for fasteners. Straps shall be fastened with $1^1/_4$-inch-long (32 mm) fasteners (#8 wood screws or 8d nails) with the number of fasteners as indicated in Table C104.4.1 and Table C104.4.2. Fasteners shall be not closer to the end of lumber than $2^1/_2$ inches (64 mm).

[BS] C104.4.1 L-bent strap method. Retrofit studs shall be connected to horizontal braces or to strong backs in accordance with Figure C104.2(1), C104.2(2) or C104.2.3, and shall comply with the following conditions:

1. A strap shall be applied to the edges of a retrofit stud nearest the gable end wall and to the face of horizontal braces using at each end of the strap the number of fasteners specified in Table C104.4.1. Straps shall be long enough so that each strap extends sufficient distance onto the vertical face of the retrofit stud that the fastener closest to the ends of the studs is not less than $2^1/_2$ inches (64 mm) from the end of the stud. Straps shall be permitted to be twisted to accommodate the transition between the tops of retrofit studs and horizontal bracings following roof pitches.
2. Compression blocks shall be installed on the horizontal braces directly against either the existing vertical gable end wall stud or the retrofit stud. Figure C104.2(1) (trusses) and Figure C104.2(2) (conventionally framed) show the installation of the compression block against the existing vertical gable end wall stud with the strap from the retrofit stud running beside the compression block. Compression blocks shall be permitted to be placed over straps. Compression blocks shall be fastened to the horizontal braces with not fewer than the minimum number of 3-inch-long (76 mm) fasteners (#8 wood screws or 10d nails) specified in Table C104.4.1. End and edge distances for fasteners shall be in accordance with Section C103.5.3.

[BS]TABLE C104.4.1—ELEMENT SIZING AND SPACING FOR L-BENT RETROFIT METHOD

RETROFIT ELEMENTS	RETROFIT CONFIGURATION			
	A	B	C	D
Minimum size and number of Horizontal Braces	2 × 4	2 × 4	2 × 4	2 each 2 × 4
Minimum size and number of Retrofit Studs	2 × 4	2 × 6	2 × 8	2 each 2 × 8
Minimum number of fasteners connecting each end of straps to Retrofit Studs or to Horizontal Braces #8 screws or 10d nails $1^1/_4$" long	6	9	12	8 on each strap
Minimum number of fasteners to connect Compression Blocks to Horizontal Braces #8 screws or 10d nails 3" long	6	8	10	12

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

[BS] C104.4.2 U-bent strap method. Retrofit studs shall be connected to horizontal braces in accordance with Figure C104.2(3) or C104.2(4), shall be limited to Retrofit Configurations A and B as defined in Table C104.2, and shall comply with the following conditions:

1. Straps of sufficient length to meet the requirements for the number of fasteners in accordance with Table C104.4.2 and meet the end distance requirements of Section C103.5.3 shall be shaped around retrofit studs and fastened to the edges of horizontal braces. Straps shall wrap the back edge of the retrofit stud snugly with a maximum gap of $^1/_4$ inch (6.4 mm). Rounded bends of straps shall be permitted. One fastener shall be installed that connects each strap to the side of the associated retrofit stud.
2. The horizontal brace shall butt snugly against the retrofit stud with a maximum gap of $^1/_4$ inch (6.4 mm).
3. Straps shall be permitted to be twisted to accommodate the transition between the tops of retrofit studs and horizontal braces that follow the roof pitch.

[BS] TABLE C104.4.2—ELEMENT SIZING AND SPACING FOR U-BENT RETROFIT METHOD

RETROFIT ELEMENTS	RETROFIT CONFIGURATION			
	A	B	C	D
Minimum size and number of Horizontal Braces	2 × 4	2 × 4	2 × 4	2 each 2 × 4
Minimum size and number of Retrofit Studs	2 × 4	2 × 6	2 × 8	2 each 2 × 8
Minimum number of fasteners connecting Straps to each edge of Horizontal Braces #8 screws or 10d nails $1^1/_4$" long	6	7	7	6 on each side of strap

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

[BS] C104.5 Connection of gable end wall to wall below. The bottom chords or bottom members of wood-framed gable end walls shall be attached to the wall below using one of the methods prescribed in Section C104.5.1 or C104.5.2. The particular method chosen shall correspond to the framing system and type of wall construction encountered.

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[BS] C104.5.1 Gable end frame. The bottom chords of the gable end frame shall be attached to the wall below using gusset angles. Not fewer than two fasteners shall be installed into the bottom chord. The gusset angles shall be installed throughout the portion of the gable end where the gable end wall height is greater than 3 feet (91 cm) at the spacing specified in Table C104.5.1. Connection to the wall below shall be by one of the following methods:

1. For a wood-frame wall below, not fewer than two fasteners shall be installed. The fasteners shall be of the same diameter and style specified by the gusset angle manufacturer and sufficient length to extend through the double top plate of the wall below.
2. For a concrete or masonry wall below without a sill plate, the type and number of fasteners into the wall shall be consistent with the gusset angle manufacturer's specifications for fasteners installed in concrete or masonry.
3. For a concrete or masonry wall below with a 2x sill plate, the fasteners into the wall below shall be of the diameter and style specified by the gusset angle manufacturer for concrete or masonry connections; but, long enough to pass through the wood sill plate and provide the required embedment into the concrete or masonry below. Alternatively, the gusset angle can be anchored to the sill plate using four each $1^1/_2$-inch-long (38 mm) fasteners of the same type as specified by the gusset angle manufacturer for wood connections, provided that the sill plate is anchored to the wall on each side of the gusset angle by a $^1/_4$-inch-diameter (6.4 mm) masonry screw with $2^3/_4$ inches (70 mm) of embedment into the concrete or masonry wall. A $^1/_4$-inch (6.4 mm) washer shall be placed under the heads of the masonry screws.

[BS]TABLE C104.5.1—SPACING OF GUSSET ANGLES

EXPOSURE CATEGORY	BASIC WIND SPEED (mph)	SPACING OF GUSSET ANGLES (inches)
C	140	38
C	150	32
C	165	28
C	180	24
C	190	20
B	140	48
B	150	40
B	165	36
B	180	30
B	190	26

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

[BS] C104.5.2 Conventionally framed gable end wall. Each stud in a conventionally framed gable end wall, throughout the length of the gable end wall where the wall height is greater than 3 feet (914 mm), shall be attached to the bottom or sill plate using a stud to plate connector with minimum uplift capacity of 175 pounds (778 N). The bottom or sill plate shall then be connected to the wall below using one of the following methods:

1. For a wood frame wall below, the sill or bottom plate shall be connected to the top plate of the wall below using $^1/_4$-inch-diameter (6.4 mm) lag bolt fasteners of sufficient length to penetrate the bottom plate of the upper gable end wall and extend through the bottom top plate of the wall below. A washer sized for the diameter of the lag bolt shall be placed under the head of each lag bolt. The fasteners shall be installed at the spacing indicated in Table C104.5.2.
2. For a concrete or masonry wall below, the sill or bottom plate shall be connected to the concrete or masonry wall below using $^1/_4$-inch-diameter (6.4 mm) concrete or masonry screws of sufficient length to provide $2^3/_4$ inches (70 mm) of embedment into the top of the concrete or masonry wall. A washer sized for the diameter of the lag bolt shall be placed under the head of each lag bolt. The fasteners shall be installed at the spacing indicated in Table C104.5.2.

[BS]TABLE C104.5.2—SPACING OF LAG OR MASONRY SCREWS USED TO CONNECT SILL PLATE OF GABLE END WALL TO TOP OF THE WALL BELOW		
EXPOSURE CATEGORY	**BASIC WIND SPEED (mph)**	**SPACING OF LAG OR MASONRY SCREWS (inches)**
C	140	19
C	150	16
C	165	14
C	180	14
C	190	10
B	140	24
B	150	20
B	165	18
B	180	15
B	190	13
For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.		

CHAPTER C2 ROOF DECK FASTENING FOR HIGH-WIND AREAS

SECTION C201—GENERAL

[BS] C201.1 Purpose. This chapter provides prescriptive methods for partial structural retrofit of an *existing building* to increase its resistance to wind loads. It is intended for voluntary use where the basic wind speed, *V*, is greater than 130 mph (58 m/s) in accordance with Figure 1609.3(2) of the *International Building Code* and for reference by mitigation programs. The provisions of this chapter do not necessarily satisfy requirements for new construction. Unless specifically cited, the provisions of this chapter do not necessarily satisfy requirements for structural improvements triggered by *addition, alteration, repair, change of occupancy*, building relocation or other circumstances.

[BS] C201.2 Eligible conditions. The provisions of this chapter are applicable only to buildings that meet either of the following eligibility requirements:

1. Buildings assigned to *Risk Category* I or II in accordance with Table 1604.5 of the *International Building Code*.
2. Buildings within the scope of the *International Residential Code*.

SECTION C202—ROOF DECK ATTACHMENT FOR WOOD ROOFS

[BS] C202.1 Roof decking attachment for one- and two-family dwellings. For one- and two-family dwellings, fastening shall be in accordance with Section C202.1.1 or C202.1.2 as appropriate for the existing construction. The diameter of 8d nails shall be not less than 0.131 inch (3 mm) and the length shall be not less than $2^1/_4$ inches (57 mm) to qualify for the provisions of this section for existing nails regardless of head shape or head diameter.

[BS] C202.1.1 Sawn lumber or wood plank roofs. Roof decking consisting of sawn lumber or wood planks up to 12 inches (30 cm) wide and secured with not fewer than two nails (minimum size 8d) to each roof framing member it crosses shall be deemed to be sufficiently connected. Sawn lumber or wood plank decking secured with smaller fasteners than 8d nails or with fewer than two nails (minimum size 8d) to each framing member it crosses shall be deemed sufficiently connected if fasteners are added such that two clipped head, round head or ring shank nails (minimum size 8d) are in place on each framing member the nail crosses.

[BS] C202.1.2 Wood structural panel roofs For roof decking consisting of wood structural panels, fasteners and spacings required in Table C202.1.2 shall be deemed to comply with the requirements of Section 706.3.

Supplemental fasteners as required by Table C202.1.2 shall be 8d ring shank nails with round heads and the following minimum dimensions:

1. 0.113-inch-nominal (3 mm) shank diameter.
2. Ring diameter not less than 0.012 inch (0.3 mm) greater than shank diameter.
3. 16 to 20 rings per inch.
4. A minimum 0.280-inch (7 mm) full round head diameter.
5. Ring shank to extend not less than $1^1/_2$ inches (38 mm) from the tip of the nail.
6. Minimum $2^1/_4$-inch (57 mm) nail length.

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[BS] TABLE C202.1.2—SUPPLEMENT FASTENERS AT PANEL EDGES AND INTERMEDIATE FRAMING				
EXISTING FASTENERS	**EXISTING FASTENER SPACING (EDGE OR INTERMEDIATE SUPPORTS)**	**MAXIMUM SUPPLEMENTAL FASTENER SPACING FOR 130 MPH < V_{ult} ≤ 140 MPH**	**MAXIMUM SUPPLEMENTAL FASTENER SPACING FOR INTERIOR ZONE[c] LOCATIONS FOR MPH V_{ult} > 140 MPH AND EDGE ZONES NOT COVERED BY THE COLUMN TO THE RIGHT**	**EDGE ZONE[d] FOR V_{ult} > 160 MPH AND EXPOSURE C, OR V_{ult} > 180 MPH AND EXPOSURE B**
Staples or 6d	Any	6″ o.c.[b]	6″ o.c.[b]	4″ o.c.[b] at panel edges and 4″ o.c.[b] at intermediate supports
8d clipped head or round head smooth shank	6″ o.c. or less	None necessary	None necessary along edges of panels but 6″ o.c.[b] at intermediate supports of panel	4″ o.c.[a] at panel edges and 4″ o.c.[a] at intermediate supports
8d clipped head or round head ring shank	6″ o.c. or less	None necessary	None necessary	4″ o.c.[a] at panel edges and 4″ o.c.[a] at intermediate supports
8d clipped head or round head smooth shank	Greater than 6″ o.c.	6″ o.c.[a]	6″ o.c.[a] along panel edges and 6″ o.c.[b] at intermediate supports of panel	4″ o.c.[a] at panel edges and 4″ o.c.[a] at intermediate supports
8d clipped head or round head ring shank	Greater than 6″ o.c.	6″ o.c.[a]	6″ o.c.[a]	4″ o.c.[a] at panel edges and 4″ o.c.[a] at intermediate supports

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

a. Maximum spacing determined based on existing fasteners and supplemental fasteners.

b. Maximum spacing determined based on supplemental fasteners only.

c. Interior zone = sheathing that is not located within 4 feet of the perimeter edge of the roof or within 4 feet of each side of a ridge.

d. Edge zone = sheathing that is located within 4 feet of the perimeter edge of the roof and within 4 feet of each side of a ridge.

CHAPTER C3 REFERENCED STANDARDS

SECTION C301—REFERENCED STANDARDS

[BS] C301.1 General. See Table C301.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

[BS]TABLE C301.1—REFERENCED STANDARDS		
STANDARD ACRONYM	**STANDARD NAME**	**SECTIONS HEREIN REFERENCED**
IBC—24	*International Building Code*®	C101.3, C103.2, C201.1, C201.2
IRC—24	*International Residential Code*®	C101.2, C101.3, C103.2, C201.2

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APPENDIX

D

[NY] RESERVED

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APPENDIX

E

TEMPORARY EMERGENCY USES

User notes:

About this appendix: *The primary purpose for Appendix E is to provide guidance for designers, engineers, architects and fire and code officials to allow temporary emergency uses of existing buildings with respect to the minimum code requirements. This appendix is intended to serve as a template or checklist for use during an emergency that references the relevant code requirements.*

SECTION E101—GENERAL

[NY] E101.1 Scope. The provisions of this appendix are applicable when a State or Federal emergency declaration is issued. The provisions of this appendix shall apply to the use, installation, *alteration*, relocation and location of *existing buildings* and any service utilities or systems that serve such *existing buildings* during or based on the response to the emergency.

E101.1.1 Objective. The objective of this appendix is to provide flexibility for the *code official* to permit the temporary uses of *existing buildings* during an emergency to address unusual circumstances that temporarily overwhelm response capabilities of an entity while maintaining the level of safety intended by the code.

E101.1.2 Temporary use. Where temporary uses during emergencies exceed 180 days, judgement shall be used by the *code official* to allow for temporary uses and conditions to continue for the duration of the emergency based on the needs of the emergency. The *code official* is authorized to grant extensions for demonstrated cause.

SECTION E102—DEFINITIONS

E102.1 General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of this code for general definitions.

EMERGENCY. Any event declared by local, state or federal entities that temporarily overwhelms response capabilities and that requires the temporary suspension or modification of regulations, codes or standards to facilitate response to such an event.

TEMPORARY USE. An activity or practice that is established at a designated location for a period of less than 180 days. Uses include, but are not limited to, those functional designations listed within the occupancy group descriptions in Section 302.1 of the *Building Code of New York State*.

SECTION E103—SUBMITTAL DOCUMENTS

E103.1 General. Submittal documents shall be of sufficient clarity to indicate the location, nature and extent of the work or use proposed and show in detail that it will conform to the provisions of this code and relevant laws, ordinances, rules and regulations, as determined by the *code official*.

SECTION E104—CONFORMANCE

E104.1 General. Temporary use of *existing buildings* shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to provide a reasonable level of safety, health and general welfare as determined by the *code official*.

E104.2 Changes over time. As an *emergency* evolves, submittal documents shall be submitted to demonstrate that the temporary uses of the *existing buildings* are in compliance with the requirements of this code.

SECTION E105—PERMITS

E105.1 Emergency permits. In an emergency situation, where an existing building undergoes a temporary *change of use* or *occupancy*, the permit application shall be submitted as soon as practicable to the *code official*.

SECTION E106—GENERAL STANDARDS FOR EMERGENCY USES

E106.1 Scope. The provisions of Sections E106.2 through E106.7 shall apply to all *existing structures* being repurposed and to all structures relocated to support the response to an *emergency.*

E106.2 Intent. The intent of this section is to provide a reasonable level of safety in a structure repurposed for *emergency* use.

E106.3 Change of use or occupancy. *Existing buildings* used in a way that was not originally intended by occupancy class or use shall be allowed without formally changing the occupancy. The previous occupancy and use shall resume upon the conclusion of the *emergency*. Where the temporary live load of the floor is more than that required by Section 1607 of the *Building Code of New York State* for the original use, the area designated for the temporary live load shall be posted with placards for the approved live load.

E106.4 Fire safety provisions. Determination of the fire safety requirements by the *code official* shall be in accordance with Section E106.4.1 through E106.4.5 in order to make determinations of safe conditions rather than strict adherence to the provisions of the *Fire Code of New York State*.

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E106.4.1 Fire safety and evacuation plans. Fire safety and evacuation plans shall be provided in accordance with Sections 403 and 404 of the *Fire Code of New York State*. Submittal documents shall be updated where there are any physical changes to the layout of the structure.

E106.4.2 Training and practice drills. Training of staff and practice drills shall comply with Sections 405 and 406 of the *Fire Code of New York State*. Structures in place for longer than 30 days shall conduct evacuation drills in accordance with Section 405.3 of the *Fire Code of New York State* based on the temporary use.

E106.4.3 Fire protection. An evaluation shall be performed to decide on fire protection needed utilizing NFPA 550.

E106.4.4 Emergency access. Emergency vehicle access roads shall be approved by the fire code official.

E106.4.5 Fire watch. A fire watch in accordance with Section 403.11.1 of the *Fire Code of New York State* shall be permitted to be provided in lieu of other fire protection systems.

E106.5 Means of egress. Means of egress shall comply with Section 1011.5, in addition to Sections E106.5.1 through E106.5.3.

Exception: In Group I-2 occupancies, in areas where corridors are used for movement of care recipients in beds, the clear width of ramps and corridors shall be not less than 48 inches (1219 mm).

E106.5.1 Exit discharge. Exit discharge shall provide access to a public way or to a safe dispersal area in accordance with Section 1028.5 of the *Building Code of New York State.*

E106.5.2 Means of egress lighting. The means of egress shall be illuminated when the space is occupied.

Exception: Sleeping areas.

E106.5.3 Exit signs. Exit signs shall be provided where the means of egress is not readily identifiable. Exit signs shall be permitted to be illuminated by the lighting provided in the structure.

E106.6 Accessibility. A facility that is constructed to be accessible shall be maintained accessible during occupancy.

E106.7 Temporary connection. The *code official* shall have the authority to authorize the temporary connection of the building or system to the utility, the source of energy, fuel or power, or the water system or sewer system in accordance with Section 111. Water closets and lavatories shall be either permanent plumbing fixtures installed within the structure or temporary water closets or lavatories, such as chemical toilets or other means approved by the *code official*.

E106.7.1 Portable heating, cooling and cooking equipment. Portable heating, cooling and cooking equipment shall be used in accordance with the *Fire Code of New York State*, their listing and manufacturer's instructions.

SECTION E107—USE OF SPECIFIC STANDARDS

E107.1 Increased occupant load. Allowing for additional occupants in *existing buildings* shall comply with Sections E107.1.1 through E107.1.3.

E107.1.1 Authorization. The *code official* is authorized to allow for an increase in the number of occupants or a *change of use* in a building or portion of a building during an *emergency*.

E107.1.2 Maintenance of the means of egress. The existing means of egress shall be maintained.

E107.1.3 Sleeping areas. Where a space is used for sleeping purposes, the space shall be equipped with smoke alarms in accordance with Sections 907.2.6.1.1 and 907.2.11 of the *Fire Code of New York State*or be provided with a fire watch in accordance with Section 403.11.1 of the *Fire Code of New York State*. Carbon monoxide alarms shall be installed in accordance with Section 915 of the *Fire Code of New York State* where the structure uses any fossil fuel or wood burning appliances.

E107.2 Temporary health care facilities. Temporary health care facilities shall comply with Sections E107.2.1 and E107.2.2.

E107.2.1 General. Temporary health care facilities shall be erected, maintained and operated to minimize the possibility of a fire emergency requiring the evacuation of occupants.

E107.2.2 Membrane structures under projections. Membrane structures of less than 100 square feet (9.3 m^2) shall be permitted to be placed under projections of a permanent building, provided the permanent building is protected with an automatic sprinkler system installed in accordance with Section 903.3.1.1 of the *Fire Code of New York State*.

E107.3 Use of tiny houses or manufactured homes. Tiny houses or manufactured homes used for temporary housing shall comply with Sections E107.3.1 through E107.3.5.

E107.3.1 Fire separation distances. Tiny houses or manufactured homes shall be separated by not less than 5 feet (1524 mm) between structures.

E107.3.2 Fire breaks. Tiny houses and manufactured homes shall not be located in groups of more than 20 units. Fire breaks of at least 20 feet (6096 mm) shall be provided between each group.

E107.3.3 Smoke alarms. Tiny houses and manufactured homes used for sleeping purposes shall be equipped with a smoke alarm complying with Section 907.2.11 of the *Fire Code of New York State*. Smoke alarms are not required to be hard wired.

E107.3.4 Carbon monoxide alarms. Carbon monoxide alarms shall be installed in accordance with Section 915 of the *Fire Code of New York State,* where the tiny house or manufactured home uses any fossil fuel or wood-burning appliances.

[NY] E107.3.5 Reserved.

[NY] SECTION E108—RESERVED

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APPENDIX

F

[NY] DIAPER CHANGING STATIONS

User notes:

About this appendix: *Appendix F implements the provisions of subdivisions sixteen and seventeen of Section 378 of the Executive Law, as added by Chapter 58 of the Laws of 2018 and provides the standards for the installation of diaper changing stations in buildings that have one or more areas classified as Assembly Group A occupancies or Mercantile Group M occupancies.*

[NY] SECTION F101—GENERAL

[NY] F101.1 General. *Diaper changing stations* shall be installed in all *newly constructed buildings* that have one or more areas classified as *Assembly Group A occupancies* or *Mercantile Group M occupancies* and in all *existing buildings* that have one or more areas classified as *Assembly Group A occupancies* or *Mercantile Group M occupancies* and undergo a *substantial renovation*.

[NY] SECTION F102—DEFINITIONS

[NY] F102.1 Definitions. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of this code for general definitions.

[NY] ASSEMBLY GROUP A OCCUPANCY. An *assembly Group A occupancy* as described in Section 303 of the *Building Code of New York State*.

[NY] DIAPER CHANGING STATION. A *diaper changing station*, deck, table, or similar amenity that is in intended for use by the public for the purpose of changing diapers on children weighing not more than 50 pounds.

[NY] EXISTING BUILDING. A *building* constructed before January 1, 2019. For the purposes of this appendix, where a substantially complete application for a permit for the original construction of a *building* has been submitted to the *authority having jurisdiction* before January 1, 2019, such *building* shall be deemed to have been constructed before January 1, 2019 and, accordingly, shall be deemed to be an *existing building*.

[NY] MERCANTILE GROUP M OCCUPANCY. A *mercantile Group M occupancy* as described in Section 309 of the *Building Code of New York State*.

[NY] NEWLY CONSTRUCTED BUILDING. A *building* constructed on or after January 1, 2019. Where a substantially complete application for a permit for the original construction of a *building* has been submitted to the *authority having jurisdiction* on or after January 1, 2019, such *building* shall be deemed to have been constructed on or after January 1, 2019 and, accordingly, shall be deemed to be a *newly constructed building*.

[NY] PUBLIC FAMILY OR ASSISTED-USE TOILET ROOM. A family or assisted-use toilet room as described in Section 1110.2.1 of the *Building Code of New York State* that is intended for use by customers and patrons of and visitors to an area classified as an *Assembly Group A occupancy* or *Mercantile Group M occupancy.*

[NY] PUBLIC TOILET ROOM. A room containing public toilet facilities intended for use by customers and patrons of and visitors to an area classified as an *Assembly Group A occupancy* or *Mercantile Group M occupancy*. The term "*public toilet room*" includes *public family or assisted-use toilet room*, a *public toilet room* available for use by both sexes (hereinafter referred to as a "unisex *public toilet room*"), a *public toilet room* available for use only by males (hereinafter referred to as a "male *public toilet room*"), and a *public toilet room* available for use only by females (hereinafter referred to as a "female *public toilet room*"). A room that meets this definition will continue to be deemed to be a *public toilet room* for the purposes of this appendix even if such room contains both employee toilet facilities and public toilet facilities.

[NY] SUBSTANTIAL RENOVATION. Work performed on a *building* that includes one or more of the categories of work described in Section F103.2.

[NY] SECTION F103—GENERAL REQUIREMENTS

[NY] F103.1 Newly constructed buildings. In all *newly constructed buildings* that have one or more areas classified as an *Assembly Group A occupancy* or *Mercantile Group M occupancy*, at least one safe, sanitary, and convenient *diaper changing station* available for use by both male and female occupants (or at least one such *diaper changing station* available for use by male occupants and at least one such *diaper changing station* available for use by female occupants) shall be provided on each floor level containing a *public toilet room*.

[NY] F103.2 Existing buildings. Except as otherwise provided in Sections F103.3 and F103.4, in an *existing building* that undergoes work in any one or more of the categories described in this subdivision and has, upon completion of such work, one or more areas classified as an *Assembly Group A occupancy* or *Mercantile Group M occupancy*, safe, sanitary, and convenient *diaper changing stations* shall be provided as follows:

1. In the case of the construction or installation of a new *public family or assisted-use toilet room* or a new unisex *public toilet room*, at least one such *diaper changing station* shall be provided in the newly constructed or installed *public family or assisted-use toilet room* or unisex *public toilet room*.

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2. In the case of the construction or installation of a new male *public toilet room* and a new female *public toilet room* on the same floor level, at least one such *diaper changing station* shall be provided in the newly constructed or installed male *public toilet room* and at least one such *diaper changing station* shall be provided in the newly constructed or installed female *public toilet room*.
3. In the case of a Level 2 *alteration* of an existing public *family or assisted-use toilet room*, an existing unisex *public toilet room*, or an existing male *public toilet room* and an existing female *public toilet room* that are both on the same floor level, at least one such *diaper changing station* shall be provided in each *public toilet room* undergoing the Level 2 *alteration*.
4. In the case of a Level 3 *alteration* of an *existing building* where the *work area* includes an existing *public family or assisted-use toilet room*, an existing unisex *public toilet room*, or an existing male *public toilet room* and an existing female *public toilet room* that are both on the same floor level, at least one such *diaper changing station* shall be provided in each *public toilet room* included in the *work area* of the Level 3 *alteration*.
5. In the case of work that does not fall in any category described in Items 1, 2, 3, or 4 of this section; is a Level 2 or Level 3 *alteration* of an *existing building*; and has a *work area* that includes at least 50 percent of the area of an *Assembly Group A occupancy* or *Mercantile Group M occupancy*; safe, sanitary, and convenient *diaper changing stations* shall be provided as follows:
    5.1. Where such *Assembly Group A occupancy* or *Mercantile Group M occupancy* is served by an existing *public family or assisted-use toilet room* and a *diaper changing station* can be provided in such existing *public family or assisted-use toilet room* without having to reconfigure the space therein or increase the floor area thereof, at least one such *diaper changing station* shall be provided in such existing *public family or assisted-use toilet room*.
    5.2. Where such *Assembly Group A occupancy* or *Mercantile Group M occupancy* is served by an existing unisex *public toilet room* and a *diaper changing station* can be provided in such existing unisex *public toilet room* without having to reconfigure the space therein or increase the floor area thereof, at least one such *diaper changing station* shall be provided in such existing unisex *public toilet room*.
    5.3. Where such *Assembly Group A occupancy* or *Mercantile Group M occupancy* is served by an existing male *public toilet room* and an existing female *public toilet room* that are both on the same floor level and a *diaper changing station* can be provided in both of such existing *public toilet rooms* without having to reconfigure the space in or increase the floor area of either of such existing *public toilet rooms*, at least one such *diaper changing station* shall be provided in such existing male *public toilet room* and at least one such *diaper changing station* shall be provided in such existing female *public toilet room*.

[NY] F103.3 Exception. Notwithstanding any provision of Section F103.2 to the contrary, if an *existing building* undergoes work in any category described in Section F103.2, not more than one *diaper changing station* available for use by both male and female occupants (or one *diaper changing station* available for use by male occupants and one *diaper changing station* available for use by female occupants) shall be required on any floor level.

[NY] F103.4 Transitional provision. Notwithstanding any provision of Section F103.2 to the contrary, if an *existing building* undergoes work in any category described in Section F103.2 and a substantially complete application for a permit for such work has been submitted to the *authority having jurisdiction* before January 1, 2019, the requirements of Section F103.2 shall not apply to such work.

[NY] SECTION F104—ACCESSIBILITY, CONSTRUCTION, AND INSTALLATION REQUIREMENTS

[NY] F104.1 Accessibility. All *diaper changing stations* shall, at a minimum, comply with the accessibility requirements of Section 603.5 (Diaper Changing Tables) of ICC A117.1.

[NY] F104.2 Design. All *diaper changing stations* shall be designed for use with children weighing up to 50 pounds (22.7 kg) and shall include a child restraint system.

[NY] F104.3 Listing and labeling. Commercially manufactured wall-mounted or recessed *diaper changing stations listed* and labeled as complying with ASTM F2285 shall be approved, and shall be installed in accordance with the manufacturer's installation instructions, the requirements of this appendix, and any and all other applicable requirements of the *Uniform Code*.

[NY] F104.4 Installation. Commercially manufactured countertop *diaper changing stations* shall be *approved* and shall be installed in accordance with the manufacturer's installation instructions, the requirements of this appendix, and any and all other applicable requirements of the *Uniform Code*.

[NY] F104.5 Construction. Non-commercially manufactured *diaper changing stations* shall be *approved* and shall be constructed and installed in accordance with the requirements of this appendix and any and all other applicable requirements of the *Uniform Code*.

[NY] SECTION F105—SIGNAGE

[NY] F105.1 Signage. In each building that has one or more areas classified as an *Assembly Group A occupancy* or *Mercantile Group M occupancy* and in which at least one *diaper changing station* is installed on or after January 1, 2019 (whether voluntarily, pursuant to this appendix, or pursuant to any other applicable law), each *public toilet room* that does not have a *diaper changing station* shall be provided with a sign indicating the location of the nearest *diaper changing station* that is available for use by the gender using such *public toilet room*. Where a *diaper changing station* is not available for use by a gender in a building, no such sign shall be required in or adjacent to each *public toilet room* available for use by that gender. Such signs shall be readily visible, shall be posted in a conspic-

uous place in or adjacent to the *public toilet room*, and shall comply with Section 703.2 (Visual Characters) of ICC A117.1. No such sign shall be required in or adjacent to a *public toilet room* in which any d*iaper changing station* is located.

[NY] SECTION F106—MAINTENANCE

[NY] F106.1 Maintenance. *Diaper changing stations* installed in any building (whether voluntarily, pursuant to this appendix, or pursuant to any other applicable law) shall be maintained in a safe, sanitary, and working condition.

[NY] SECTION F107—HISTORIC BUILDINGS

[NY] F107.1 Historic building. *Historic buildings* are exempt from the requirements of this appendix except the requirements of Sections F105 and F106.

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RESOURCE

A

GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

User note:

About this resource: *In the process of repair and alteration of existing buildings, based on the nature and the extent of the work, this code might require certain upgrades in the fire-resistance rating of building elements, at which time it becomes critical for the designers and the code officials to be able to determine the fire-resistance rating of the existing building elements as part of the overall evaluation for the assessment of the need for improvements. This resource document provides a guideline for such an evaluation for fire-resistance rating of archaic materials.*

INTRODUCTION

The *Existing Building Code of New York State* (EBCNYS) is a comprehensive code with the goal of addressing all aspects of work taking place in existing buildings and providing user-friendly methods and tools for regulation and improvement of such buildings. This resource document is included within the cover of the EBCNYS with that goal in mind and as a step towards accomplishing that goal.

In the process of *repair* and *alteration* of existing buildings, based on the nature and the extent of the work, the EBCNYS might require certain upgrades in the fire-resistance rating of building elements, at which time it becomes critical for the designers and the code officials to be able to determine the fire-resistance rating of the *existing building* elements as part of the overall evaluation for the assessment of the need for improvements. This resource document provides a guideline for such an evaluation for fire-resistance ratings of archaic materials that are not typically found in the modern model building codes.

Resource A is only a guideline and is not intended to be a document for specific adoption as it is not written in the format or language of ICC's International Codes and is not subject to the code development process.

PURPOSE

The *Guidelines on Fire Ratings of Archaic Materials and Assemblies* focuses upon the fire-related performance of archaic construction. "Archaic" encompasses construction typical of an earlier time, generally prior to 1950. "Fire-related performance" includes fire resistance, flame spread, smoke production and degree of combustibility.

The purpose of this guideline is to update the information which was available at the time of original construction, for use by architects, engineers and code officials when evaluating the fire safety of a rehabilitation project. In addition, information relevant to the evaluation of general classes of materials and types of construction is presented for those cases when documentation of the fire performance of a particular archaic material or assembly cannot be found.

It has been assumed that the building materials and their fastening, joining and incorporation into the building structure are sound mechanically. Therefore, some determination must be made that the original manufacture, the original construction practice and the rigors of aging and use have not weakened the building. This assessment can often be difficult because process and quality control was not good in many industries, and variations among locally available raw materials and manufacturing techniques often resulted in a product which varied widely in its strength and durability. The properties of iron and steel, for example, varied widely, depending on the mill and the process used.

There is nothing inherently inferior about archaic materials or construction techniques. The pressures that promote fundamental change are most often economic or technological matters not necessarily related to concerns for safety. The high cost of labor made wood lath and plaster uneconomical. The high cost of land and the congestion of the cities provided the impetus for high-rise construction. Improved technology made it possible. The difficulty with archaic materials is not a question of suitability, but familiarity.

Code requirements for the fire performance of key building elements (e.g., walls, floor/ceiling assemblies, doors, shaft enclosures) are stated in performance terms: hours of fire resistance. It matters not whether these elements were built in 1908 or 1980, only that they provide the required degree of fire resistance. The level of performance will be defined by the local community, primarily through the enactment of a building or rehabilitation code. This guideline is only a tool to help evaluate the various building elements, regardless of what the level of performance is required to be.

The problem with archaic materials is simply that documentation of their fire performance is not readily available. The application of engineering judgment is more difficult because building officials may not be familiar with the materials or construction method involved. As a result, either a full-scale fire test is required or the archaic construction in question removed and replaced. Both alternatives are time consuming and wasteful.

This guideline and the accompanying appendix are designed to help fill this information void. By providing the necessary documentation, there will be a firm basis for the continued acceptance of archaic materials and assemblies.

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1—FIRE-RELATED PERFORMANCE OF ARCHAIC MATERIALS AND ASSEMBLIES

1.1 FIRE PERFORMANCE MEASURES

This guideline does not specify the level of performance required for the various building components. These requirements are controlled by the building occupancy and use and are set forth in the local building or rehabilitation code.

The fire resistance of a given building element is established by subjecting a sample of the assembly to a "standard" fire test which follows a "standard" time-temperature curve. This test method has changed little since the 1920s. The test results tabulated in the Appendix have been adjusted to reflect current test methods.

The current model building codes cite other fire-related properties not always tested for in earlier years: flame spread, smoke production and degree of combustibility. However, they can generally be assumed to fall within well-defined values because the principal combustible component of archaic materials is cellulose. Smoke production is more important today because of the increased use of plastics. However, the early flame spread tests, developed in the early 1940s, also included a test for smoke production.

"Plastics," one of the most important classes of contemporary materials, were not found in the review of archaic materials. If plastics are to be used in a rehabilitated building, they should be evaluated by contemporary standards. Information and documentation of their fire-related properties and performance is widely available.

Flame spread, smoke production and degree of combustibility are discussed in detail below. Test results for eight common species of lumber, published in an Underwriter's Laboratories' (UL) report (104), are noted in the following table:

TABLE 1.1
TUNNEL TEST RESULTS FOR EIGHT SPECIES OF LUMBER

SPECIES OF LUMBER	FLAME SPREAD	FUEL CONTRIBUTED	SMOKE DENSITY
Western White Pine	75	50-60	50
Northern White Pine	120–215	120–140	60–65
Ponderosa Pine	80–215	120–135	100–110
Yellow Pine	180–190	130–145	275–305
Red Gum	140–155	125–175	40–60
Yellow Birch	105–110	100–105	45–65
Douglas Fir	65–100	50–80	10–100
Western Hemlock	60—75	40—65	40—120

Flame Spread

The flame spread of interior finishes is most often measured by the ASTM E84 "tunnel test." This test measures how far and how fast the flames spread across the surface of the test sample. The resulting flame spread rating (FSR) is expressed as a number on a continuous scale where cement-asbestos board is 0 and red oak is 100. (Materials with a flame spread greater than red oak have an FSR greater than 100.) The scale is divided into distinct groups or classes. The most commonly used flame spread classifications are: Class I or A, with a 0–25 FSR; Class II or B, with a 26–75 FSR; and Class III or C, with a 76–200 FSR. (Note: Some codes use Roman numerals and others use letters.) The *NFPA Life Safety Code* also has a Class D (201–500 FSR) and Class E (over 500 FSR) interior finish.

These classifications are typically used in modern building codes to restrict the rate of fire spread. Only the first three classifications are normally permitted, though not all classes of materials can be used in all places throughout a building. For example, the interior finish of building materials used in exits or in corridors leading to exits is more strictly regulated than materials used within private dwelling units.

In general, inorganic archaic materials (e.g., bricks or tile) can be expected to be in Class I. Materials of whole wood are mostly Class II. Whole wood is defined as wood used in the same form as sawn from the tree. This is in contrast to the contemporary reconstituted wood products such as plywood, fiberboard, hardboard or particle board. If the organic archaic material is not whole wood, the flame spread classification could be well over 200 and thus would be particularly unsuited for use in exits and other critical locations in a building. Some plywoods and various wood fiberboards have flame spreads over 200. Although they can be treated with fire retardants to reduce their flame spread, it would be advisable to assume that all such products have a flame spread over 200 unless there is information to the contrary.

Smoke Production

The evaluation of smoke density is part of the ASTM E84 tunnel test. For the eight species of lumber shown in Table 1.1, the highest levels are 275–305 for Yellow Pine, but most of the others are less smoky than red oak which has an index of 100. The advent of plastics caused substantial increases in the smoke density values measured by the tunnel test. The ensuing limitation of the smoke production for wall and ceiling materials by the model building codes has been a reaction to the introduction of plastic materials. In general, cellulosic materials fall in the 50–300 range of smoke density which is below the general limitation of 450 adopted by many codes.

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Degree of Combustibility

The model building codes tend to define "noncombustibility" on the basis of having passed ASTM E136 or if the material is totally inorganic. The acceptance of gypsum wallboard as noncombustible is based on limiting paper thickness to not over $^1/_8$ inch and a 0–50 flame spread rating by ASTM E84. At times there were provisions to define a Class I or A material (0–25 FSR) as noncombustible, but this is not currently recognized by most model building codes.

If there is any doubt whether or not an archaic material is noncombustible, it would be appropriate to send out samples for evaluation. If an archaic material is determined to be noncombustible according to ASTM E136, it can be expected that it will not contribute fuel to the fire.

1.2 COMBUSTIBLE CONSTRUCTION TYPES

One of the earliest forms of timber construction used exterior load-bearing masonry walls with columns and/or wooden walls supporting wooden beams and floors in the interior of the building. This form of construction, often called "mill" or "heavy timber" construction, has approximately 1-hour fire resistance. The exterior walls will generally contain the fire within the building.

With the development of dimensional lumber, there was a switch from heavy timber to "balloon frame" construction. The balloon frame uses load-bearing exterior wooden walls which have long timbers often extending from foundation to roof. When longer lumber became scarce, another form of construction, "platform" framing, replaced the balloon framing. The difference between the two systems is significant because platform framing is automatically fire-blocked at every floor while balloon framing commonly has concealed spaces that extend unblocked from basement to attic. The architect, engineer and *code official* must be alert to the details of construction and the ease with which fire can spread in concealed spaces.

2—BUILDING EVALUATION

A given rehabilitation project will most likely go through several stages. The preliminary evaluation process involves the designer in surveying the prospective building. The fire resistance of *existing building* materials and construction systems is identified; potential problems are noted for closer study. The final evaluation phase includes: developing design solutions to upgrade the fire resistance of building elements, if necessary; preparing working drawings and specifications; and the securing of the necessary code approvals.

2.1 PRELIMINARY EVALUATION

A preliminary evaluation should begin with a building survey to determine the existing materials, the general arrangement of the structure and the use of the occupied spaces, and the details of construction. The designer needs to know "what is there" before a decision can be reached about what to keep and what to remove during the rehabilitation process. This preliminary evaluation should be as detailed as necessary to make initial plans. The fire-related properties need to be determined from the applicable building or rehabilitation code, and the materials and assemblies existing in the building then need to be evaluated for these properties. Two worksheets are shown below to facilitate the preliminary evaluation.

Two possible sources of information helpful in the preliminary evaluation are the original building plans and the building code in effect at the time of original construction. Plans may be on file with the local building department or in the offices of the original designers (e.g., architect, engineer) or their successors. If plans are available, the investigator should verify that the building was actually constructed as called for in the plans, as well as incorporate any later alterations or changes to the building. Earlier editions of the local building code should be on file with the building official. The code in effect at the time of construction will contain fire performance criteria. While this is no guarantee that the required performance was actually provided, it does give the investigator some guidance as to the level of performance which may be expected. Under some code administration and enforcement systems, the code in effect at the time of construction also defines the level of performance that must be provided at the time of rehabilitation.

Table 2.1(1) illustrates one method for organizing preliminary field notes. Space is provided for the materials, dimensions and condition of the principal building elements. Each floor of the structure should be visited and the appropriate information obtained. In practice, there will often be identical materials and construction on every floor, but the exception may be of vital importance. A schematic diagram should be prepared of each floor showing the layout of exits and hallways and indicating where each element described in the field notes fits into the structure as a whole. The exact arrangement of interior walls within apartments is of secondary importance from a fire safety point of view and need not be shown on the drawings unless these walls are required by code to have a fire-resistance rating.

The location of stairways and elevators should be clearly marked on the drawings. All exterior means of escape (e.g., fire escapes) should be identified. (Note: Problems providing adequate exiting are discussed at length in the *Egress Guideline for Residential Rehabilitation*.)

The following notes explain the entries in Table 2.1(1).

Exterior Bearing Walls. Many old buildings utilize heavily constructed walls to support the floor/ceiling assemblies at the exterior of the building. There may be columns and/or interior bearing walls within the structure, but the exterior walls are an important factor in assessing the fire safety of a building.

The field investigator should note how the floor/ceiling assemblies are supported at the exterior of the building. If columns are incorporated in the exterior walls, the walls may be considered nonbearing.

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Interior Bearing Walls. It may be difficult to determine whether or not an interior wall is load bearing, but the field investigator should attempt to make this determination. At a later stage of the rehabilitation process, this question will need to be determined exactly. Therefore, the field notes should be as accurate as possible.

Exterior Nonbearing Walls. The fire resistance of the exterior walls is important for two reasons. These walls (both bearing and nonbearing) are depended upon to: a) contain a fire within the building of origin; or b) keep an exterior fire *outside* the building. It is therefore important to indicate on the drawings where any openings are located as well as the materials and construction of all doors or shutters. The drawings should indicate the presence of wired glass, its thickness and framing, and identify the materials used for windows and door frames. The protection of openings adjacent to exterior means of escape (e.g., exterior stairways, fire escapes) is particularly important. The ground floor drawing should locate the building on the property and indicate the precise distances to adjacent buildings.

Interior Nonbearing Walls (Partitions). A partition is a "wall that extends from floor to ceiling and subdivides space within any story of a building" (see Bibliography entry 35). Table 2.1(1) has two categories (A & B) for Interior Nonbearing Walls (Partitions) which can be used for different walls, such as hallway walls as compared to inter-apartment walls. Under some circumstances there may be only one type of wall construction; in others, three or more types of wall construction may occur.

The field investigator should be alert for differences in function as well as in materials and construction details. In general, the details within apartments are not as important as the major exit paths and exit stairways. The preliminary field investigation should attempt to determine the thickness of all walls. A term introduced below called "thickness design" will depend on an accurate ($\pm\ ^1/_4$ inch) determination. Even though this initial field survey is called "preliminary," the data generated should be as accurate and complete as possible.

The field investigator should note the exact location from which observations are recorded. For instance, if a hole is found through a wall enclosing an exit stairway which allows a cataloguing of the construction details, the field investigation notes should reflect the location of the "find." At the preliminary stage it is not necessary to core every wall; the interior details of construction can usually be determined at some location.

Structural Frame. There may or may not be a complete skeletal frame, but usually there are columns, beams, trusses or other like elements. The dimensions and spacing of the structural elements should be measured and indicated on the drawings. For instance, if there are 10-inch-square columns located on a 30-foot-square grid throughout the building, this should be noted. The structural material and cover or protective materials should be identified wherever possible. The thickness of the cover materials should be determined to an accuracy of $\pm\ ^1/_4$ inch. As discussed above, the preliminary field survey usually relies on accidental openings in the cover materials rather than a systematic coring technique.

Floor/Ceiling Structural Systems. The span between supports should be measured. If possible, a sketch of the cross-section of the system should be made. If there is no location where accidental damage has opened the floor/ceiling construction to visual inspection, it is necessary to make such an opening. An evaluation of the fire resistance of a floor/ceiling assembly requires detailed knowledge of the materials and their arrangement. Special attention should be paid to the cover on structural steel elements and the condition of suspended ceilings and similar membranes.

Roofs. The preliminary field survey of the roof system is initially concerned with watertightness. However, once it is apparent that the roof is sound for ordinary use and can be retained in the rehabilitated building, it becomes necessary to evaluate the fire performance. The field investigator must measure the thickness and identify the types of materials which have been used. Be aware that there may be several layers of roof materials.

Doors. Doors to stairways and hallways represent some of the most important fire elements to be considered within a building. The uses of the spaces separated largely controls the level of fire performance necessary. Walls and doors enclosing stairways or elevator shafts would normally require a higher level of performance than between the bedroom and bath. The various uses are differentiated in Table 2.1(1).

Careful measurements of the thickness of door panels must be made, and the type of core material within each door must be determined. It should be noted whether doors have self-closing devices; the general operation of the doors should be checked. The latch should engage and the door should fit tightly in the frame. The hinges should be in good condition. If glass is used in the doors, it should be identified as either plain glass or wired glass mounted in either a wood or steel frame.

Materials. The field investigator should be able to identify ordinary building materials. In situations where an unfamiliar material is found, a sample should be obtained. This sample should measure at least 10 cubic inches so that an ASTM E136 fire test can be conducted to determine if it is combustible.

Thickness. The thickness of all materials should be measured accurately since, under certain circumstances, the level of fire resistance is very sensitive to the material thickness.

Condition. The method of attaching the various layers and facings to one another or to the supporting structural element should be noted under the appropriate building element. The "secureness" of the attachment and the general condition of the layers and facings should be noted here.

Notes. The "Notes" column can be used for many purposes, but it might be a good idea to make specific references to other field notes or drawings.

After the building survey is completed, the data collected must be analyzed. A suggested work sheet for organizing this information is given as Table 2.1(2).

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TABLE 2.1(1)
PRELIMINARY EVALUATION FIELD NOTES

BUILDING ELEMENT		MATERIALS	THICKNESS	CONDITION	NOTES
Exterior Bearing Walls					
Interior Bearing Walls					
Exterior Nonbearing Walls					
Interior Nonbearing Walls or Partitions	A				
	B				
Structural Frame: Columns					
Beams					
Other					
Floor/Ceiling Structural System: Spanning					
Roofs					
Doors (including frame and hardware): a) Enclosed vertical exitway					
b) Enclosed horizontal exitway					
c) Other					

The required fire resistance and flame spread for each building element are normally established by the local building or rehabilitation code. The fire performance of the existing materials and assemblies should then be estimated, using one of the techniques described below. If the fire performance of the *existing building* element(s) is equal to or greater than that required, the materials and assemblies may remain. If the fire performance is less than required, then corrective measures must be taken.

The most common methods of upgrading the level of protection are to either remove and replace the *existing building* element(s) or to *repair* and upgrade the existing materials and assemblies. Other fire protection measures, such as automatic sprinklers or detection and alarm systems, also could be considered, though they are beyond the scope of this guideline. If the upgraded protection is still less than that required or deemed to be acceptable, additional corrective measures must be taken. This process must continue until an acceptable level of performance is obtained.

TABLE 2.1(2)
PRELIMINARY EVALUATION WORKSHEET

BUILDING ELEMENT		REQUIRED FIRE RESISTANCE	REQUIRED FLAME SPREAD	ESTIMATED FIRE RESISTANCE	ESTIMATED FLAME SPREAD	METHOD OF UPGRADING	ESTIMATED UPGRADED PROTECTION	NOTES
Exterior Bearing Walls								
Interior Bearing Walls								
Exterior Nonbearing Walls								
Interior Nonbearing Walls or Partitions	A							
	B							
Structural Frame: Columns								
Beams								
Other								
Floor/Ceiling Structural System: Spanning								
Roofs								
Doors (including frame and hardware): a) Enclosed vertical exitway								
b) Enclosed horizontal exitway								
c) Others								

2.2 FIRE RESISTANCE OF EXISTING BUILDING ELEMENTS

The fire resistance of the *existing building* elements can be estimated from the tables and histograms contained in the Appendix. The Appendix is organized first by type of building element: walls, columns, floor/ceiling assemblies, beams and doors. Within each build-

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ing element, the tables are organized by type of construction (e.g., masonry, metal, wood frame) and then further divided by minimum dimensions or thickness of the building element.

A histogram precedes every table that has 10 or more entries. The X-axis measures fire resistance in hours; the Y-axis shows the number of entries in that table having a given level of fire resistance. The histograms also contain the location of each entry within that table for easy cross-referencing.

The histograms, because they are keyed to the tables, can speed the preliminary investigation. For example, Table 1.3.2, *Wood Frame Walls 4" to Less Than 6" Thick*, contains 96 entries. Rather than study each table entry, the histogram shows that every wall assembly listed in that table has a fire resistance of less than 2 hours. If the building code required the wall to have 2-hour fire resistance, the designer, with a minimum of effort, is made aware of a problem that requires closer study.

Suppose the code had only required a wall of 1-hour fire resistance. The histogram shows far fewer complying elements (19) than noncomplying ones (77). If the existing assembly is not one of the 19 complying entries, there is a strong possibility the existing assembly is deficient. The histograms can also be used in the converse situation. If the existing assembly is not one of the smaller number of entries with a lower than required fire resistance, there is a strong possibility the existing assembly will be acceptable.

At some point, the *existing building* component or assembly must be located within the tables. Otherwise, the fire resistance must be determined through one of the other techniques presented in the guideline. Locating the building component in the Appendix tables not only guarantees the accuracy of the fire-resistance rating, but also provides a source of documentation for the building official.

2.3 EFFECTS OF PENETRATIONS IN FIRE-RESISTANT ASSEMBLIES

There are often many features in existing walls or floor/ceiling assemblies which were not included in the original certification or fire testing. The most common examples are pipes and utility wires passed through holes poked through an assembly. During the life of the building, many penetrations are added, and by the time a building is ready for rehabilitation, it is not sufficient to just consider the fire resistance of the assembly as originally constructed. It is necessary to consider all penetrations and their relative impact upon fire performance. For instance, the fire resistance of the corridor wall may be less important than the effect of plain glass doors or transoms. In fact, doors are the most important single class of penetrations.

A fully developed fire generates substantial quantities of heat and excess gaseous fuel capable of penetrating any holes which might be present in the walls or ceiling of the fire compartment. In general, this leads to a severe degradation of the fire resistance of those building elements and to a greater potential for fire spread. This is particularly applicable to penetrations located high in a compartment where the positive pressure of the fire can force the unburned gases through the penetration.

Penetrations in a floor/ceiling assembly will generally completely negate the barrier qualities of the assembly and will lead to rapid spread of fire to the space above. It will not be a problem, however, if the penetrations are filled with noncombustible materials strongly fastened to the structure. The upper half of walls are similar to the floor/ceiling assembly in that a positive pressure can reasonably be expected in the top of the room, and this will push hot and/or burning gases through the penetration unless it is completely sealed.

Building codes require doors installed in fire-resistive walls to resist the passage of fire for a specified period of time. If the door to a fully involved room is not closed, a large plume of fire will typically escape through the doorway, preventing anyone from using the space outside the door while allowing the fire to spread. This is why door closers are so important. Glass in doors and transoms can be expected to rapidly shatter unless constructed of listed or approved wire glass in a steel frame. As with other building elements, penetrations or nonrated portions of doors and transoms must be upgraded or otherwise protected.

Table 5.1 in Section V of the Appendix contains 41 entries of doors mounted in sound tight-fitting frames. Section 3.4 below outlines one procedure for evaluating and possibly upgrading existing doors.

3—FINAL EVALUATION AND DESIGN SOLUTION

The final evaluation begins after the rehabilitation project has reached the final design stage and the choice is made to keep certain archaic materials and assemblies in the rehabilitated building. The final evaluation process is essentially a more refined and detailed version of the preliminary evaluation. The specific fire-resistance and flame-spread requirements are determined for the project. This may involve local building and fire officials reviewing the preliminary evaluation as depicted in Tables 2.1(1) and 2.1(2) and the field drawings and notes. When necessary, provisions must be made to upgrade *existing building* elements to provide the required level of fire performance.

There are several approaches to design solutions that can make possible the continued use of archaic materials and assemblies in the rehabilitated structure. The simplest case occurs when the materials and assembly in question are found within the Appendix tables and the fire performance properties satisfy code requirements. Other approaches must be used, though, if the assembly cannot be found within the Appendix or the fire performance needs to be upgraded. These approaches have been grouped into two classes: experimental and theoretical.

3.1 THE EXPERIMENTAL APPROACH

If a material or assembly found in a building is not listed in the Appendix tables, there are several other ways to evaluate fire performance. One approach is to conduct the appropriate fire test(s) and thereby determine the fire-related properties directly. There are a number of laboratories in the United States which routinely conduct the various fire tests.

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The contract with any of these testing laboratories should require their observation of specimen preparation as well as the testing of the specimen. A complete description of where and how the specimen was obtained from the building, the transportation of the specimen, and its preparation for testing should be noted in detail so that the building official can be satisfied that the fire test is representative of the actual use.

The test report should describe the fire test procedure and the response of the material or assembly. The laboratory usually submits a cover letter with the report to describe the provisions of the fire test that were satisfied by the material or assembly under investigation. A building official will generally require this cover letter but will also read the report to confirm that the material or assembly complies with the code requirements. Local code officials should be involved in all phases of the testing process.

The experimental approach can be costly and time consuming because specimens must be taken from the building and transported to the testing laboratory. When a load-bearing assembly has continuous reinforcement, the test specimen must be removed from the building, transported and tested in one piece. However, when the fire performance cannot be determined by other means, there may be no alternative to a full-scale test.

A "nonstandard" small-scale test can be used in special cases. Sample sizes need only be 10–25 square feet (0.93–2.3 m^2), while full-scale tests require test samples of either 100 or 180 square feet (9.3 or 17 m^2) in size. This small-scale test is best suited for testing nonload-bearing assemblies against thermal transmission only.

3.2 THE THEORETICAL APPROACH

There will be instances when materials and assemblies in a building undergoing rehabilitation cannot be found in the Appendix tables. Even where test results are available for more or less similar construction, the proper classification may not be immediately apparent. Variations in dimensions, loading conditions, materials or workmanship may markedly affect the performance of the individual building elements, and the extent of such a possible effect cannot be evaluated from the tables.

Theoretical methods being developed offer an alternative to the full-scale fire tests discussed above. For example, Section 4302(b) of the 1979 edition of the *Uniform Building Code* specifically allows an engineering design for fire resistance in lieu of conducting full-scale tests. These techniques draw upon computer simulation and mathematical modeling, thermodynamics, heat-flow analysis and materials science to predict the fire performance of building materials and assemblies.

One theoretical method, known as the "Ten Rules of Fire Endurance Ratings," was published by T. Z. Harmathy in the May, 1965 edition of *Fire Technology* (see Bibliography entry 35). Harmathy's Rules provide a foundation for extending the data within the Appendix tables to analyze or upgrade current as well as archaic building materials or assemblies.

HARMATHY'S TEN RULES

Rule 1: The "thermal" fire endurance of a construction consisting of a number of parallel layers is greater than the sum of the "thermal" fire endurances characteristic of the individual layers when exposed separately to fire. (Note: The "thermal" fire endurance is the time at which the average tempurature on the unexposed side of a construction exceeds its initial value by 250°F (121°C) when the other side is exposed to the "standard" fire specified by ASTM Test Method E-19.)

The minimum performance of an untested assembly can be estimated if the fire endurance of the individual components is known. Though the exact rating of the assembly cannot be stated, the endurance of the assembly is greater than the sum of the endurance of the components.

When a building assembly or component is found to be deficient, the fire endurance can be upgraded by providing a protective membrane. This membrane could be a new layer of brick, plaster or drywall. The fire endurance of this membrane is called the "finish rating." Appendix tables 1.5.1 and 1.5.2 contain the finish ratings for the most commonly employed materials. (See also the notes to Rule 2.)

The test criteria for the finish rating is the same as for the thermal fire endurance of the total assembly: average temperature increases of 250°F (121°C) above ambient or 325°F (163°C) above ambient at any one place with the membrane being exposed to the fire. The temperature is measured at the interface of the assembly and the protective membrane.

Rule 2: The fire endurance of a construction does not decrease with the addition of further layers.

Harmathy notes that this rule is a consequence of the previous rule. Its validity follows from the fact that the additional layers increase both the resistance to heat flow and the heat capacity of the construction. This, in turn, reduces the rate of temperature rise at the unexposed surface.

This rule is not just restricted to "thermal" performance but affects the other fire test criteria: direct flame passage, cotton waste ignition and load bearing performance. This means that certain restrictions must be imposed on the materials to be added and on the loading conditions. One restriction is that a new layer, if applied to the exposed surface, must not produce additional thermal stresses in the construction, i.e., its thermal expansion characteristics must be similar to those of the adjacent layer. Each new layer must also be capable of contributing enough additional strength to the assembly to sustain the added dead load. If this requirement is not fulfilled, the allowable live load must be reduced by an amount equal to the weight of the new layer. Because of these limitations, this rule should not be applied without careful consideration.

Particular care must be taken if the material added is a good thermal insulator. Properly located, the added insulation could improve the "thermal" performance of the assembly. Improperly located, the insulation could block necessary thermal transmission through the assembly, thereby subjecting the structural elements to greater temperatures for longer periods of time, and could cause premature structural failure of the supporting members.

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Rule 3: The fire endurance of constructions containing continuous air gaps or cavities is greater than the fire endurance of similar constructions of the same weight, but containing no air gaps or cavities.

By providing for voids in a construction, additional resistances are produced in the path of heat flow. Numerical heat flow analyses indicate that a 10 to 15 percent increase in fire endurance can be achieved by creating an air gap at the midplane of a brick wall. Since the gross volume is also increased by the presence of voids, the air gaps and cavities have a beneficial effect on stability as well. However, constructions containing combustible materials within an air gap may be regarded as exceptions to this rule because of the possible development of burning in the gap.

There are numerous examples of this rule in the tables. For instance:

Table 1.1.4; Item W-8-M-82: Cored concrete masonry, nominal 8 inch thick wall with one unit in wall thickness and with 62 percent minimum of solid material in each unit, load bearing (80 PSI). Fire endurance: $2^{1}/_{2}$ hours.

Table 1.1.5; Item W-10-M-11: Cored concrete masonry, nominal 10 inch thick wall with two units in wall thickness and a 2-inch (51 mm) air space, load bearing (80 PSI). The units are essentially the same as item W-8-M-82. Fire endurance: $3^{1}/_{2}$ hours.

These walls show 1 hour greater fire endurance by the addition of the 2-inch (51 mm) air space.

Rule 4: The farther an air gap or cavity is located from the exposed surface, the more beneficial is its effect on the fire endurance.

Radiation dominates the heat transfer across an air gap or cavity, and it is markedly higher where the temperature is higher.

The air gap or cavity is thus a poor insulator if it is located in a region which attains high temperatures during fire exposure.

Some of the clay tile designs take advantage of these factors. The double cell design, for instance, ensures that there is a cavity near the unexposed face. Some floor/ceiling assemblies have air gaps or cavities near the top surface and these enhance their thermal performance.

Rule 5: The fire endurance of a construction cannot be increased by increasing the thickness of a completely enclosed air layer.

Harmathy notes that there is evidence that if the thickness of the air layer is larger than about $^{1}/_{2}$ inch (12.7 mm), the heat transfer through the air layer depends only on the temperature of the bounding surfaces, and is practically independent of the distance between them. This rule is not applicable if the air layer is not completely enclosed, i.e., if there is a possibility of fresh air entering the gap at an appreciable rate.

Rule 6: Layers of materials of low thermal conductivity are better utilized on that side of the construction on which fire is more likely to happen.

As in Rule 4, the reason lies in the heat transfer process, though the conductivity of the solid is much less dependent on the ambient temperature of the materials. The low thermal conductor creates a substantial temperature differential to be established across its thickness under transient heat flow conditions. This rule may not be applicable to materials undergoing physical-chemical changes accompanied by significant heat absorption or heat evolution.

Rule 7: The fire endurance of asymmetrical constructions depends on the direction of heat flow.

This rule is a consequence of Rules 4 and 6, as well as other factors. This rule is useful in determining the relative protection of corridors and walls enclosing an exit stairway from the surrounding spaces. In addition, there are often situations where a fire is more likely, or potentially more severe, from one side or the other.

Rule 8: The presence of moisture, if it does not result in explosive spalling, increases the fire endurance.

The flow of heat into an assembly is greatly hindered by the release and evaporation of the moisture found within cementitious materials such as gypsum, Portland cement or magnesium oxychloride. Harmathy has shown that the gain in fire endurance may be as high as 8 percent for each percent (by volume) of moisture in the construction. It is the moisture chemically bound within the construction material at the time of manufacture or processing that leads to increased fire endurance. There is no direct relationship between the relative humidity of the air in the pores of the material and the increase in fire endurance.

Under certain conditions there may be explosive spalling of low permeability cementitious materials such as dense concrete. In general, one can assume that extremely old concrete has developed enough minor cracking that this factor should not be significant.

Rule 9: Load-supporting elements, such as beams, girders and joists, yield higher fire endurances when subjected to fire endurance tests as parts of floor, roof or ceiling assemblies than they would when tested separately.

One of the fire endurance test criteria is the ability of a load-supporting element to carry its design load. The element will be deemed to have failed when the load can no longer be supported.

Failure usually results for two reasons. Some materials, particularly steel and other metals, lose much of their structural strength at elevated temperatures. Physical deflection of the supporting element, due to decreased strength or thermal expansion, causes a redistribution of the load forces and stresses throughout the element. Structural failure often results because the supporting element is not designed to carry the redistributed load.

Roof, floor and ceiling assemblies have primary (e.g., beams) and secondary (e.g., floor joists) structural members. Since the primary load-supporting elements span the largest distances, their deflection becomes significant at a stage when the strength of the secondary members (including the roof or floor surface) is hardly affected by the heat. As the secondary members follow the deflection of the primary load-supporting element, an increasingly larger portion of the load is transferred to the secondary members.

When load-supporting elements are tested separately, the imposed load is constant and equal to the design load throughout the test. By definition, no distribution of the load is possible because the element is being tested by itself. Without any other structural

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members to which the load could be transferred, the individual elements cannot yield a higher fire endurance than they do when tested as parts of a floor, roof or ceiling assembly.

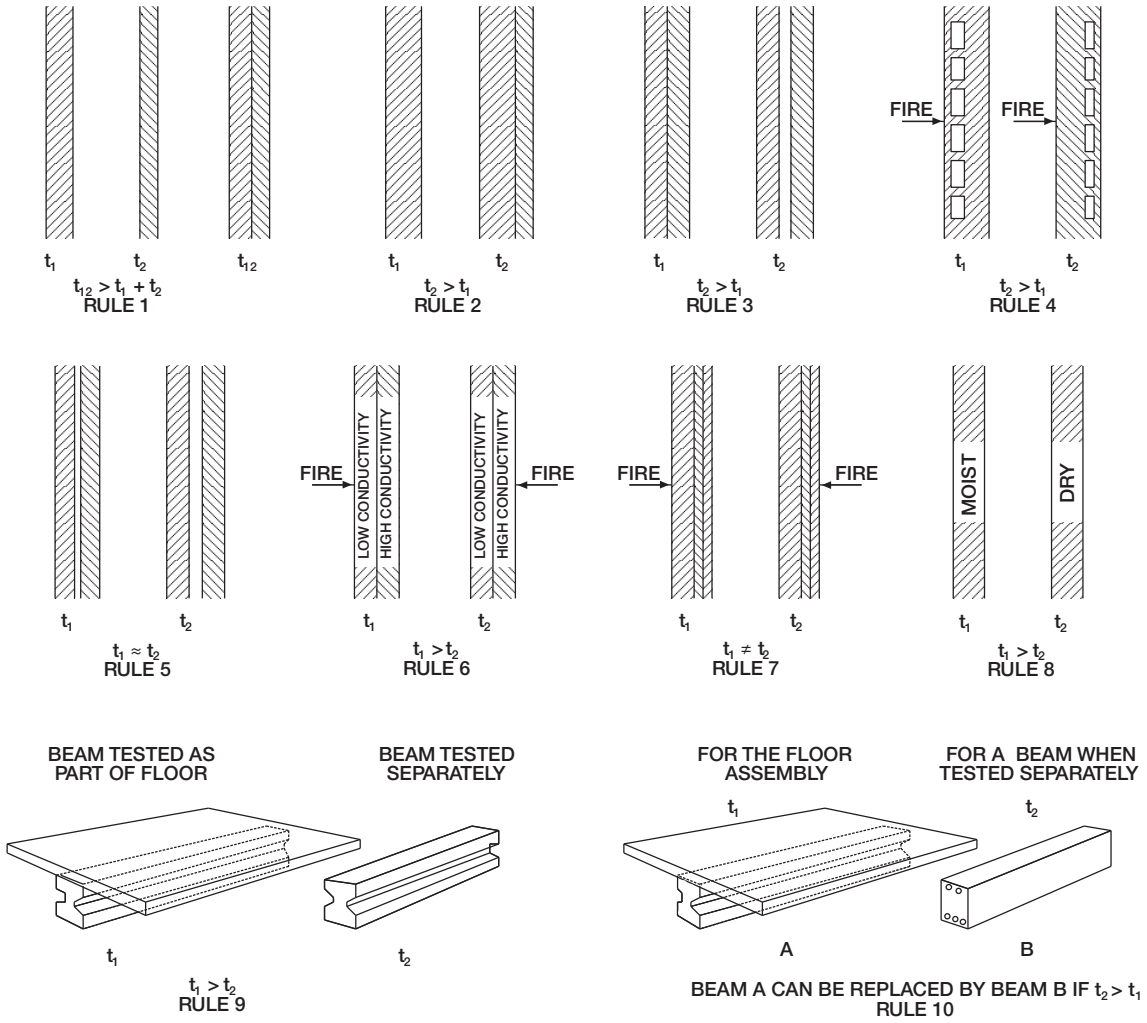
Rule 10: The load-supporting elements (beams, girders, joists, etc.) of a floor, roof or ceiling assembly can be replaced by such other load-supporting elements which, when tested separately, yielded fire endurances not less than that of the assembly.

This rule depends on Rule 9 for its validity. A beam or girder, if capable of yielding a certain performance when tested separately, will yield an equally good or better performance when it forms a part of a floor, roof or ceiling assembly. It must be emphasized that the supporting element of one assembly must not be replaced by the supporting element of another assembly if the performance of this latter element is not known from a separate (beam) test. Because of the load-reducing effect of the secondary elements that results from a test performed on an assembly, the performance of the supporting element alone cannot be evaluated by simple arithmetic. This rule also indicates the advantage of performing separate fire tests on primary load-supporting elements.

ILLUSTRATION OF HARMATHY'S RULES

Harmathy provided one schematic figure which illustrated his rules. It should be useful as a quick reference to assist in applying his rules.

FIGURE 3.2—DIAGRAMMATIC ILLUSTRATION OF HARMATHY'S TEN RULES[a]



t = Fire endurance

a. Reproduced from the May 1965 *Fire Technology* (Vol. 1, No. 2). Copyright National Fire Protection Association, Boston. Reproduced by permission.

EXAMPLE APPLICATION OF HARMATHY'S RULES

The following examples, based in whole or in part upon those presented in Harmathy's paper (see Bibliography entry 35), show how the rules can be applied to practical cases.

Example 1:

Problem

A contractor would like to keep a partition which consists of a $3^3/_4$ inch (95 mm) thick layer of red clay brick, a $1^1/_4$ inch (32 mm) thick layer of plywood and a $^3/_8$ inch (9.5 mm) thick layer of gypsum wallboard at a location where 2-hour fire endurance is required. Is this assembly capable of providing a 2-hour protection?

Solution

(1) This partition does not appear in the Appendix tables.

(2) Bricks of this thickness yield fire endurances of approximately 75 minutes (Table 1.1.2, Item W-4-M-2).

(3) The $1^1/_4$ inch (32 mm) thick plywood has a finish rating of 30 minutes.

(4) The $^3/_8$ inch (9.5 mm) gypsum wallboard has a finish rating of 10 minutes.

(5) Using the recommended values from the tables and applying Rule 1, the fire endurance (FI) of the assembly is larger than the sum of the individual layers, or FI > 75 + 30 + 10 = 115 minutes

Discussion

This example illustrates how the Appendix tables can be utilized to determine the fire resistance of assemblies not explicitly listed.

Example 2:

Problem

(1) A number of buildings to be rehabilitated have the same type of roof slab which is supported with different structural elements.

(2) The designer and contractor would like to determine whether or not this roof slab is capable of yielding a 2-hour fire endurance. According to a rigorous interpretation of ASTM E119, however, only the roof assembly, including the roof slab as well as the cover and the supporting elements, can be subjected to a fire test. Therefore, a fire endurance classification cannot be issued for the slabs separately.

(3) The designer and contractor believe this slab will yield a 2-hour fire endurance even without the cover, and any beam of at least 2-hour fire endurance will provide satisfactory support. Is it possible to obtain a classification for the slab separately?

Solution

(1) The answer to the question is yes.

(2) According to Rule 10, it is not contrary to common sense to test and classify roofs and supporting elements separately. Furthermore, according to Rule 2, if the roof slabs actually yield a 2-hour fire endurance, the endurance of an assembly, including the slabs, cannot be less than 2 hours.

(3) The recommended procedure would be to review the tables to see if the slab appears as part of any tested roof or floor/ceiling assembly. The supporting system can be regarded as separate from the slab specimen, and the fire endurance of the assembly listed in the table is at least the fire endurance of the slab. There would have to be an adjustment for the weight of the roof cover in the allowable load if the test specimen did not contain a cover.

(4) The supporting structure or element would have to have at least a 2-hour fire endurance when tested separately.

Discussion

If the tables did not include tests on assemblies which contained the slab, one procedure would be to assemble the roof slabs on any convenient supporting system (not regarded as part of the specimen) and to subject them to a load which, besides the usually required superimposed load, includes some allowances for the weight of the cover.

Example 3:

Problem

A steel-joisted floor and ceiling assembly is known to have yielded a fire endurance of 1 hour and 35 minutes. At a certain location, a 2-hour endurance is required. What is the most economical way of increasing the fire endurance by at least 25 minutes?

Solution

(1) The most effective technique would be to increase the ceiling plaster thickness. Existing coats of paint would have to be removed and the surface properly prepared before the new plaster could be applied. Other materials (e.g., gypsum wallboard) could also be considered.

(2) There may be other techniques based on other principles, but an examination of the drawings would be necessary.

Discussion

(1) The additional plaster has at least three effects:

a) The layer of plaster is increased and thus there is a gain of fire endurance (Rule 1).

b) There is a gain due to shifting the air gap farther from the exposed surface (Rule 4).

c) There is more moisture in the path of heat flow to the structural elements (Rules 7 and 8).

(2) The increase in fire endurance would be at least as large as that of the finish rating for the added thickness of plaster. The combined effects in (1) above would further increase this by a factor of 2 or more, depending upon the geometry of the assembly.

Example 4:

Problem

The fire endurance of item W-10-M-l in Table 1.1.5 is 4 hours. This wall consists of two $3^3/_4$ inch (95 mm) thick layers of structural tiles separated by a 2-inch (51 mm) air gap and $^3/_4$ inch (19 mm) Portland cement plaster or stucco on both sides. If the actual wall in the building is identical to item W-10-M-1 except that it has a 4-inch (102 mm) air gap, can the fire endurance be estimated at 5 hours?

Solution

The answer to the question is no for the reasons contained in Rule 5.

Example 5:

Problem

In order to increase the insulating value of its precast roof slabs, a company has decided to use two layers of different concretes. The lower layer of the slabs, where the strength of the concrete is immaterial (all the tensile load is carried by the steel reinforcement), would be made with a concrete of low strength but good insulating value. The upper layer, where the concrete is supposed to carry the compressive load, would remain the original high strength, high thermal conductivity concrete. How will the fire endurance of the slabs be affected by the change?

Solution

The effect on the thermal fire endurance is beneficial:

(1) The total resistance to heat flow of the new slabs has been increased due to the replacement of a layer of high thermal conductivity by one of low conductivity.

(2) The layer of low conductivity is on the side more likely to be exposed to fire, where it is more effectively utilized according to Rule 6. The layer of low thermal conductivity also provides better protection for the steel reinforcement, thereby extending the time before reaching the temperature at which the creep of steel becomes significant.

3.3 "THICKNESS DESIGN" STRATEGY

The "thickness design" strategy is based upon Harmathy's Rules 1 and 2. This design approach can be used when the construction materials have been identified and measured but the specific assembly cannot be located within the tables. The tables should be surveyed again for thinner walls of like material and construction detail that have yielded the desired or greater fire endurance. If such an assembly can be found, then the thicker walls in the building have more than enough fire resistance. The thickness of the walls thus becomes the principal concern.

This approach can also be used for floor/ceiling assemblies, except that the thickness of the cover and the slab become the central concern. (Note: "Cover" is defined as the protective layer or membrane of material which shows the flow of heat to the structural elements.) The fire resistance of the untested assembly will be at least the fire resistance of an assembly listed in the table having a similar design but with less cover and/or thinner slabs. For other structural elements (e.g., beams and columns), the element listed in the table must also be of a similar design but with less cover thickness.

3.4 EVALUATION OF DOORS

A separate section on doors has been included because the process for evaluation presented below differs from those suggested previously for other building elements. The impact of unprotected openings or penetrations in fire resistant assemblies has been detailed in Section 2.3 above. It is sufficient to note here that openings left unprotected will likely lead to failure of the barrier under actual fire conditions.

For other types of building elements (e.g., beams, columns), the Appendix tables can be used to establish a minimum level of fire performance. The benefit to rehabilitation is that the need for a full-scale fire test is then eliminated. For doors, however, this cannot be done. The data contained in Appendix Table 5.1, Resistance of Doors to Fire Exposure, can only provide guidance as to whether a successful fire test is even feasible.

For example, a door required to have 1 hour fire resistance is noted in the tables as providing only 5 minutes. The likelihood of achieving the required 1 hour, even if the door is upgraded, is remote. The ultimate need for replacement of the doors is reasonably clear, and the expense and time needed for testing can be saved. However, if the performance documented in the table is near or in excess of what is being required, then a fire test should be conducted. The test documentation can then be used as evidence of compliance with the required level of performance.

The table entries cannot be used as the sole proof of performance of the door in question because there are too many unknown variables which could measurably affect fire performance. The wood may have dried over the years; coats of flammable varnish could have been added. Minor deviations in the internal construction of a door can result in significant differences in performance. Methods of securing inserts in panel doors can vary. The major nondestructive method of analysis, an X-ray, often cannot provide the necessary detail. It is for these, and similar reasons, that a fire test is still felt to be necessary.

It is often possible to upgrade the fire performance of an existing door. Sometimes, "as is" and modified doors are evaluated in a single series of tests when failure of the unmodified door is expected. Because doors upgraded after an initial failure must be tested again, there is a potential savings of time and money.

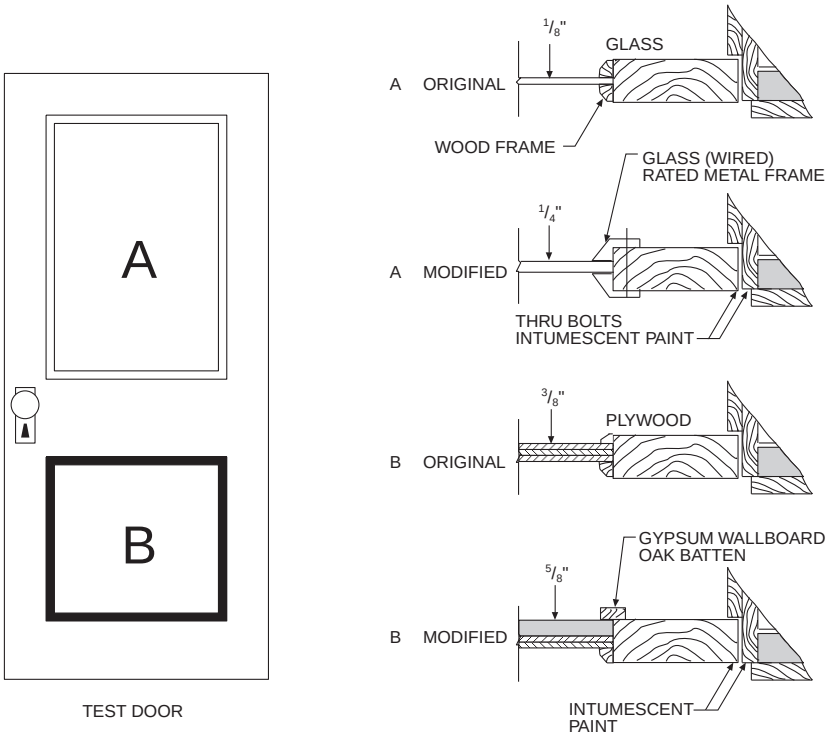
The most common problems encountered are plain glass, panel inserts of insufficient thickness and improper fit of a door in its frame. The latter problem can be significant because a fire can develop a substantial positive pressure, and the fire will work its way through otherwise innocent-looking gaps between door and frame.

One approach to solving these problems is as follows. The plain glass is replaced with approved or listed wire glass in a steel frame. The panel inserts can be upgraded by adding an additional layer of material. Gypsum wallboard is often used for this purpose. Intumescent paint applied to the edges of the door and frame will expand when exposed to fire, forming an effective seal around the edges. This seal, coupled with the generally even thermal expansion of a wood door in a wood frame, can prevent the passage of flames and other fire gases. Figure 3.4 illustrates these solutions.

Because the interior construction of a door cannot be determined by a visual inspection, there is no absolute guarantee that the remaining doors are identical to the one(s) removed from the building and tested. But the same is true for doors constructed today, and reason and judgment must be applied. Doors that appear identical upon visual inspection can be weighed. If the weights are reasonably close, the doors can be assumed to be identical and therefore provide the same level of fire performance. Another approach is to fire test more than one door or to dismantle doors selected at random to see if they had been constructed in the same manner. Original building plans showing door details or other records showing that doors were purchased at one time or obtained from a single supplier can also be evidence of similar construction.

More often though, it is what is visible to the eye that is most significant. The investigator should carefully check the condition and fit of the door and frame, and for frames out of plumb or separating from the wall. Door closers, latches and hinges must be examined to see that they function properly and are tightly secured. If these are in order and the door and frame have passed a full-scale test, there can be a reasonable basis for allowing the existing doors to remain.

FIGURE 3.4
MODIFICATION DETAILS



For SI: 1 inch = 25.4 mm.

4—SUMMARY

This section summarizes the various approaches and design solutions discussed in the preceding sections of the guideline. The term "structural system" includes: frames, beams, columns and other structural elements. "Cover" is a protective layer(s) of materials or membrane which slows the flow of heat to the structural elements. It cannot be stressed too strongly that the fire endurance of actual building elements can be greatly reduced or totally negated by removing part of the cover to allow pipes, ducts or conduits to pass through the element. This must be repaired in the rehabilitation process.

The following approaches shall be considered equivalent.

4.1 The fire resistance of a building element can be established from the Appendix tables. This is subject to the following limitations:

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The building element in the rehabilitated building shall be constructed of the same materials with the same nominal dimensions as stated in the tables.

All penetrations in the building element or its cover for services such as electricity, plumbing and HVAC shall be packed with noncombustible cementitious materials and so fixed that the packing material will not fall out when it loses its water of hydration.

The effects of age and wear and tear shall be repaired so that the building element is sound and the original thickness of all components, particularly covers and floor slabs, is maintained.

This approach essentially follows the approach taken by model building codes. The assembly must appear in a table either published in or accepted by the code for a given fire-resistance rating to be recognized and accepted.

4.2 The fire resistance of a building element which does not explicitly appear in the Appendix tables can be established if one or more elements of same design but different dimensions have been listed in the tables. For walls, the existing element must be thicker than the one listed. For floor/ceiling assemblies, the assembly listed in the table must have the same or less cover and the same or thinner slab constructed of the same material as the actual floor/ceiling assembly. For other structural elements, the element listed in the table must be of a similar design but with less cover thickness. The fire resistance in all instances shall be the fire resistance recommended in the table. This is subject to the following limitations:

The actual element in the rehabilitated building shall be constructed of the same materials as listed in the table. Only the following dimensions may vary from those specified: for walls, the overall thickness must exceed that specified in the table; for floor/ceiling assemblies, the thickness of the cover and the slab must be greater than, or equal to, that specified in the table; for other structural elements, the thickness of the cover must be greater than that specified in the table.

All penetrations in the building element or its cover for services such as electricity, plumbing or HVAC shall be packed with noncombustible cementitious materials and so fixed that the packing material will not fall out when it loses its water of hydration.

The effects of age and wear and tear shall be repaired so that the building element is sound and the original thickness of all components, particularly covers and floor slabs, is maintained.

This approach is an application of the “thickness design” concept presented in Section 3.3 of the guideline. There should be many instances when a thicker building element was utilized than the one listed in the Appendix tables. This guideline recognizes the inherent superiority of a thicker design. (Note: “Thickness design” for floor/ceiling assemblies and structural elements refers to cover and slab thickness rather than total thickness.)

The “thickness design” concept is essentially a special case of Harmathy’s Rules (specifically Rules 1 and 2). It should be recognized that the only source of data is the Appendix tables. If other data are used, it must be in connection with the approach below.

4.3 The fire resistance of building elements can be established by applying Harmathy’s Ten Rules of Fire Resistance Ratings as set forth in Section 3.2 of the guideline. This is subject to the following limitations:

The data from the tables can be utilized subject to the limitations in Section 4.2.

Test reports from recognized journals or published papers can be used to support data utilized in applying Harmathy’s Rules.

Calculations utilizing recognized and well established computational techniques can be used in applying Harmathy’s Rules. These include, but are not limited to, analysis of heat flow, mechanical properties, deflections and load bearing capacity.

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APPENDIX

INTRODUCTION

The fire-resistance tables that follow are a part of Resource A and provide a tabular form of assigning fire-resistance ratings to various archaic building elements and assemblies.

These tables for archaic materials and assemblies do for archaic materials what Tables 721.1(1) through 721.1(3) of the *International Building Code*® do for more modern building elements and assemblies. The fire-resistance tables of Resource A should be used as described in the "Purpose and Procedure" that follows the table of contents for these tables.

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2.5.1.6	Steel Columns—Concrete Encasements	Minimum Dimension 14 in. to less than 16 in.	RESOURCE A-82
2.5.1.7	Steel Columns—Concrete Encasements	Minimum Dimension 16 in. to less than 18 in.	RESOURCE A-83
2.5.2.1	Steel Columns—Brick and Block Encasements	Minimum Dimension 10 in. to less than 12 in.	RESOURCE A-84
2.5.2.2	Steel Columns—Brick and Block Encasements	Minimum Dimension 12 in. to less than 14 in.	RESOURCE A-84
2.5.2.3	Steel Columns—Brick and Block Encasements	Minimum Dimension 14 in. to less than 16 in.	RESOURCE A-85
2.5.3.1	Steel Columns—Plaster Encasements	Minimum Dimension 6 in. to less than 8 in.	RESOURCE A-85
2.5.3.2	Steel Columns—Plaster Encasements	Minimum Dimension 8 in. to less than 10 in.	RESOURCE A-86
2.5.4.1	Steel Columns—Miscellaneous Encasements	Minimum Dimension 6 in. to less than 8 in.	RESOURCE A-86
2.5.4.2	Steel Columns—Miscellaneous Encasements	Minimum Dimension 8 in. to less than 10 in.	RESOURCE A-86
2.5.4.3	Steel Columns—Miscellaneous Encasements	Minimum Dimension 10 in. to less than 12 in.	RESOURCE A-87
2.5.4.4	Steel Columns—Miscellaneous Encasements	Minimum Dimension 12 in. to less than 14 in.	RESOURCE A-87
Section III—Floor/Ceiling Assemblies			
3.1	Reinforced Concrete		RESOURCE A-88
3.2	Steel Structural Elements		RESOURCE A-93
3.3	Wood Joist		RESOURCE A-98
3.4	Hollow Clay Tile with Reinforced Concrete		RESOURCE A-101
Section IV—Beams			
4.1.1	Reinforced Concrete	Depth 10 in. to less than 12 in.	RESOURCE A-104
4.1.2	Reinforced Concrete	Depth 12 in. to less than 14 in.	RESOURCE A-106
4.1.3	Reinforced Concrete	Depth 14 in. to less than 16 in.	RESOURCE A-107
4.2.1	Reinforced Concrete—Unprotected	Depth 10 in. to less than 12 in.	RESOURCE A-107
4.2.2	Steel—Concrete Protection	Depth 10 in. to less than 12 in.	RESOURCE A-108
Section V—Doors			
5.1	Resistance of Doors to Fire Exposure		RESOURCE A-109
Bibliography			RESOURCE A-112

PURPOSE AND PROCEDURE

The tables and histograms which follow are to be used only within the analytical framework detailed in the main body of this guideline.

Histograms precede any table with 10 or more entries. The use and interpretation of these histograms is explained in Section 2 of the guideline. The tables are in a format similar to that found in the model building codes. The following example, taken from an entry in Table 1.1.2, best explains the table format.

1. Item Code. The item code consists of a four place series in the general form w-x-y-z in which each member of the series denotes the following:

   w = Type of building element (e.g., W=Walls; F=Floors, etc.).

   x = The building element thickness rounded down to the nearest 1-inch increment (e.g., $4^{5}/_{8}$ inches is rounded off to 4 inches).

   y = The general type of material from which the building element is constructed (e.g., M=Masonry; W=Wood, etc.).

   z = The item number of the particular building element in a given table.

   The item code shown in the example W-4-M-50 denotes the following:

   W = Wall, as the building element.

   4 = Wall thickness in the range of 4 inches (102 mm) to less than 5 inches (127 mm).

   M = Masonry construction.

   50 = The 50th entry in Table 1.1.2.
2. Critical Dimension. The specific name or heading of this column identifies the dimension which, if varied, has the greatest impact on fire resistance. The critical dimension for walls, in the example here, is thickness. It is different for other building elements (e.g., depth for beams; membrane thickness for some floor/ceiling assemblies). The table entry is the named dimension of the building element measured at the time of actual testing to within $\pm^{1}/_{8}$ inch (3.2 mm) tolerance. The thickness tabulated includes facings where facings are a part of the wall construction.
3. Construction Details. The construction details provide a brief description of the manner in which the building element was constructed.
4. Performance. This heading is subdivided into two columns. The column labeled “Load” will either list the load that the building element was subjected to during the fire test or it will contain a note number which will list the load and any other significant details. If the building element was not subjected to a load during the test, this column will contain “n/a,” which means “not applicable.”

   The second column under performance is labeled “Time” and denotes the actual fire endurance time observed in the fire test.
5. Reference Number. This heading is subdivided into three columns: Pre-BMS-92; BMS-92; and Post-BMS-92. The table entry under this column is the number in the Bibliography of the original source reference for the test data.
6. Notes. Notes are provided at the end of each table to allow a more detailed explanation of certain aspects of the test. In certain tables the notes given to this column have also been listed under the “Construction Details” and/or “Load” columns.
7. Rec. Hours. This column lists the recommended fire endurance rating, in hours, of a building element. In some cases, the recommended fire endurance will be less than that listed under the “Time” column. In no case is the “Rec. Hours” greater than given in the “Time” column.

EXAMPLE ENTRY

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-M-50	$4^{5}/_{8}$″	Core: structural clay tile, see Notes 12, 16, 21; facings on unexposed side only, see Note 18.	N/A	25 min		1		3, 4, 24	$^{1}/_{3}$

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SECTION I—WALLS

FIGURE 1.1.1
MASONRY WALLS
0″ TO LESS THAN 4″ THICK

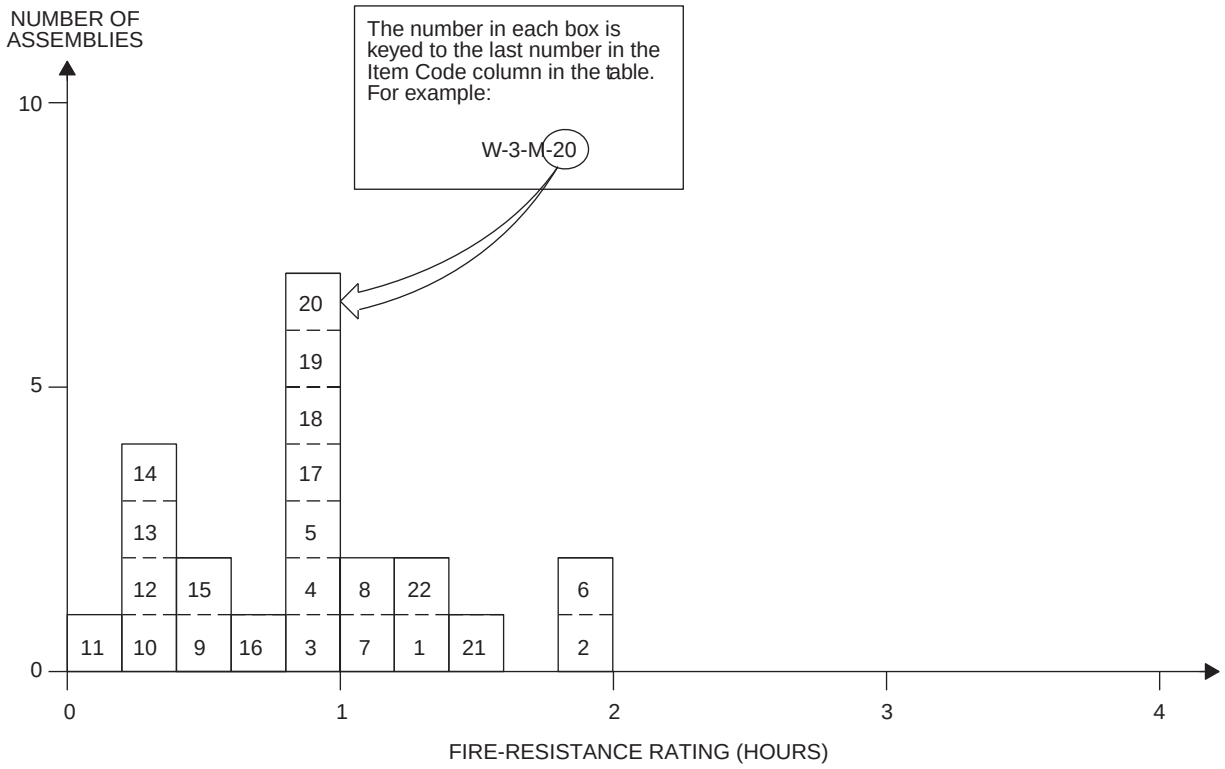

TABLE 1.1.1
MASONRY WALLS
0″ TO LESS THAN 4″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-2-M-1	$2^{1}/_{4}$″	Solid partition; $^{3}/_{4}$″ gypsum plank—10′ ×1′6″; $^{3}/_{4}$″ plus gypsum plaster each side.	N/A	1 hr 22 min			7	1	$1^{1}/_{4}$
W-3-M-2	3″	Concrete block (18″ × 9″ × 3″) of fuel ash, Portland cement and plasticizer; cement/sand mortar.	N/A	2 hrs			7	2, 3	2
W-2-M-3	2″	Solid gypsum block wall; no facings	N/A	1 hr		1		4	1
W-3-M-4	3″	Solid gypsum blocks, laid in 1:3 sanded gypsum mortar.	N/A	1 hr		1		4	1
W-3-M-5	3″	Magnesium oxysulfate wood fiber blocks; 2″ thick, laid in Portland cement-lime mortar; facings: $^{1}/_{2}$″ of 1:3 sanded gypsum plaster on both sides.	N/A	1 hr		1		4	1
W-3-M-6	3″	Magnesium oxysulfate bound wood fiber blocks; 3″ thick; laid in Portland cement-lime mortar; facings: $^{1}/_{2}$″ of 1:3 sanded gypsum plaster on both sides.	N/A	2 hrs		1		4	2

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TABLE 1.1.1—continued
MASONRY WALLS
0″ TO LESS THAN 4″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-3-M-7	3″	Clay tile; Ohio fire clay; single cell thick; face plaster: $^5/_8$″ (both sides) 1:3 sanded gypsum; design “E,” construction “A.”	N/A	1 hr 6 min			2	5, 6, 7, 11, 12, 39	1
W-3-M-8	3″	Clay tile; Illinois surface clay; single cell thick; face plaster: $^5/_8$″ (both sides) 1:3 sanded gypsum; design “A,” construction “E.”	N/A	1 hr 1 min			2	5, 8, 9, 11, 12, 39	1
W-3-M-9	3″	Clay tile; Illinois surface clay; single cell thick; no face plaster; design “A,” construction “C.”	N/A	25 min			2	5, 10, 11, 12, 39	$^1/_3$
W-3-M-10	$3^7/_8$″	8″ × $4^7/_8$″ glass blocks; weight 4 lbs each; Portland cement-lime mortar; horizontal mortar joints reinforced with metal lath.	N/A	15 min		1		4	$^1/_4$
W-3-M-11	3″	Core: structural clay tile; see Notes 14, 18, 13; no facings.	N/A	10 min		1		5, 11, 26	$^1/_6$
W-3-M-12	3″	Core: structural clay tile; see Notes 14, 19, 23; no facings.	N/A	20 min		1		5, 11, 26	$^1/_3$
W-3-M-13	$3^5/_8$″	Core: structural clay tile; see Notes 14, 18, 23; facings: unexposed side; see Note 20.	N/A	20 min		1		5, 11, 26	$^1/_3$
W-3-M-14	$3^5/_8$″	Core: structural clay tile; see Notes 14, 19, 23; facings: unexposed side only; see Note 20.	N/A	20 min		1		5, 11, 26	$^1/_3$
W-3-M-15	$3^5/_8$″	Core: clay structural tile; see Notes 14, 18, 23; facings: side exposed to fire; see Note 20.	N/A	30 min		1		5, 11, 26	$^1/_2$
W-3-M-16	$3^5/_8$″	Core: clay structural tile; see Notes 14, 19, 23; facings: side exposed to fire; see Note 20.	N/A	45 min		1		5, 11, 26	$^3/_4$
W-2-M-17	2″	2″ thick solid gypsum blocks; see Note 27.	N/A	1 hr		1		27	1
W-3-M-18	3″	Core: 3″ thick gypsum blocks 70% solid; see Note 2; no facings.	N/A	1 hr		1		27	1
W-3-M-19	3″	Core: hollow concrete units; see Notes 29, 35, 36, 38; no facings.	N/A	1 hr		1		27	1
W-3-M-20	3″	Core: hollow concrete units; see Notes 28, 35, 36, 37, 38; no facings.	N/A	1 hr		1			1
W-3-M-21	$3^1/_2$″	Core: hollow concrete units; see Notes 28, 35, 36, 37, 38; facings: one side; see Note 37.	N/A	1 hr 30 min		1			$1^1/_2$
W-3-M-22	$3^1/_2$″	Core: hollow concrete units; see Notes 29, 35, 36, 38; facings: one side, see Note 37.	N/A	1 hr 15 min		1			$1^1/_4$

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, °C = [(°F) - 32]/1.8.

Notes:

1. Failure mode—flame thru.
2. Passed 2-hour fire test (Grade “C” fire res. - British).
3. Passed hose stream test.
4. Tested at NBS under ASA Spec. No. A2-1934. As non-load-bearing partitions.
5. Tested at NBS under ASA Spec. No. 42-1934 (ASTM C19-33), except that hose stream testing where carried out was run on test specimens exposed for full test duration, not for a reduced period as is contemporarily done.
6. Failure by thermal criteria—maximum temperature rise 325°F.
7. Hose stream failure.
8. Hose stream—pass.
9. Specimen removed prior to any failure occurring.
10. Failure mode—collapse.
11. For clay tile walls, unless the source or density of the clay can be positively identified or determined, it is suggested that the lowest hourly rating for the fire endurance of a clay tile partition of that thickness be followed. Identified sources of clay showing longer fire endurance can lead to longer time recommendations.
12. See appendix for construction and design details for clay tile walls.
13. Load: 80 psi for gross wall area.
14. One cell in wall thickness.
15. Two cells in wall thickness.
16. Double shells plus one cell in wall thickness.
17. One cell in wall thickness, cells filled with broken tile, crushed stone, slag cinders or sand mixed with mortar.
18. Dense hard-burned clay or shale tile.
19. Medium-burned clay tile.
20. Not less than $^5/_8$ inch thickness of 1:3 sanded gypsum plaster.

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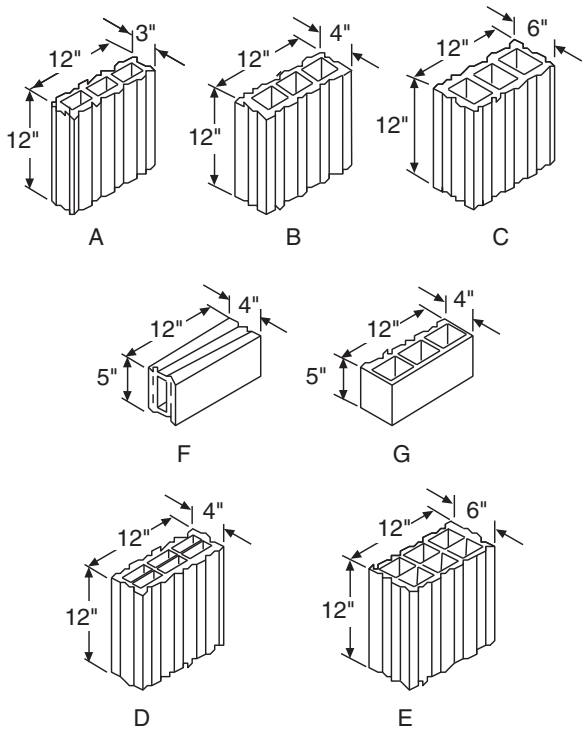
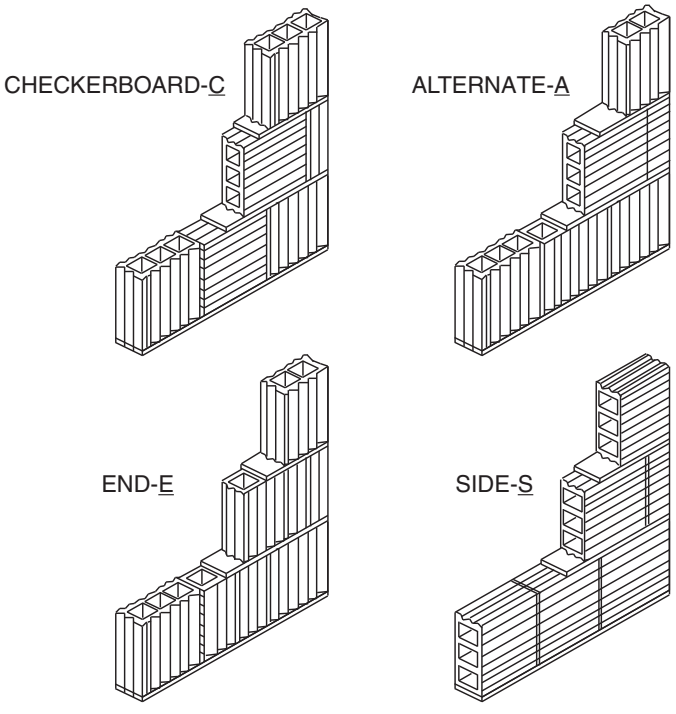
TABLE 1.1.1—continued
MASONRY WALLS
0″ TO LESS THAN 4″ THICK

21. Units of not less than 30 percent solid material.
22. Units of not less than 40 percent solid material.
23. Units of not less than 50 percent solid material.
24. Units of not less than 45 percent solid material.
25. Units of not less than 60 percent solid material.
26. All tiles laid in Portland cement-lime mortar.
27. Blocks laid in 1:3 sanded gypsum mortar voids in blocks not to exceed 30 percent.
28. Units of expanded slag or pumice aggregate.
29. Units of crushed limestone, blast furnace, slag, cinders and expanded clay or shale.
30. Units of calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.
31. Units of siliceous sand and gravel. Ninety percent or more quartz, chert or flint.
32. Unit at least 49 percent solid.
33. Unit at least 62 percent solid.
34. Unit at least 65 percent solid.
35. Unit at least 73 percent solid.
36. Ratings based on one unit and one cell in wall thickness.
37. Minimum of $^1/_2$ inch—1:3 sanded gypsum plaster.
38. Non-load-bearing.
39. See clay tile partition design construction drawings below.



DESIGNS OF TILES USED IN FIRE-TEST PARTITIONS



THE FOUR TYPES OF CONSTRUCTION USED IN FIRE-TEST PARTITIONS

FIGURE 1.1.2
MASONRY WALLS
4″ TO LESS THAN 6″ THICK

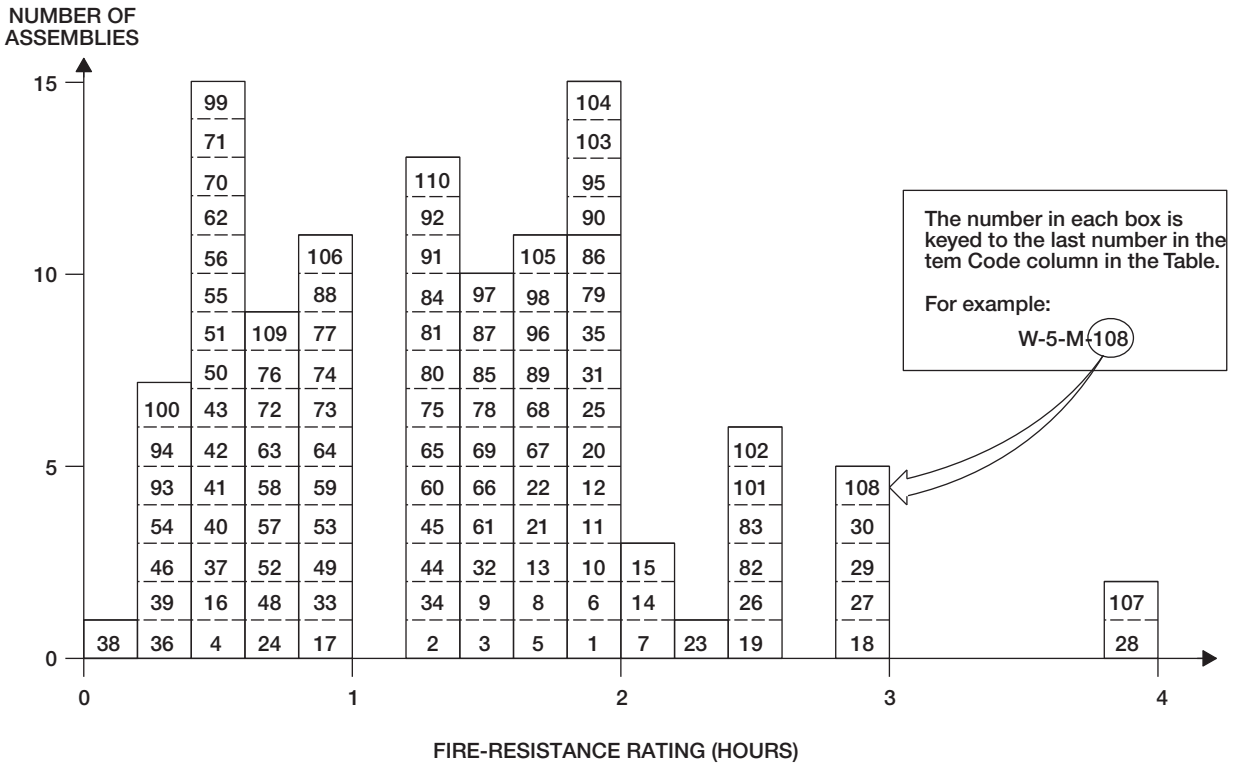


TABLE 1.1.2
MASONRY WALLS
4″ TO LESS THAN 6″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-M-1	4″	Solid 3″ thick, gypsum blocks laid in 1:3 sanded gypsum mortar; facings: $^1/_2$″ of 1:3 sanded gypsum plaster (both sides).	N/A	2 hrs		1		1	2
W-4-M-2	4″	Solid clay or shale brick.	N/A	1 hr 15 min		1		1, 2	$1^1/_4$
W-4-M-3	4″	Concrete; no facings.	N/A	1 hr 30 min		1		1	$1^1/_2$
W-4-M-4	4″	Clay tile; Illinois surface clay; single cell thick; no face plaster; design “B,” construction “C.”	N/A	25 min			2	3–7, 36	$^1/_3$
W-4-M-5	4″	Solid sand-lime brick.	N/A	1 hr 45 min		1		1	$1^3/_4$
W-4-M-6	4″	Solid wall; 3″ thick block; $^1/_2$″ plaster each side; $17^3/_4$″ × $8^3/_4$″ × 4″ “Breeze Blocks”; Portland cement/sand mortar.	N/A	1 hr 52 min			7	2	$1^3/_4$
W-4-M-7	4″	Concrete (4020 psi); reinforcement: vertical $^3/_8$″; horizontal $^1/_4$″; 6″ × 6″ grid.	N/A	2 hrs 10 min			7	2	2
W-4-M-8	4″	Concrete wall (4340 psi crush); reinforcement $^1/_4$″ diameter rebar on 8″ centers (vertical and horizontal).	N/A	1 hr 40 min			7	2	$1^2/_3$
W-4-M-9	$4^3/_{16}$″	$4^3/_{16}$″ × $2^5/_8$″ cellular fletton brick (1873 psi) with $^1/_2$″ sand mortar; bricks are U-shaped yielding hollow cover (approx. 2″ × 4″) in final cross-section configuration.	N/A	1 hr 25 min			7	2	$1^1/_3$
W-4-M-10	$4^1/_4$″	$4^1/_4$″ × $2^1/_2$″ fletton (1831 psi) brick in $^1/_2$″ sand mortar.	N/A	1 hr 53 min			7	2	$1^3/_4$

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TABLE 1.1.2—continued
MASONRY WALLS
4″ TO LESS THAN 6″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-M-11	4 1/4″	4 1/4″ × 2 1/2″ London stock (683 psi) brick; 1/2″ grout.	N/A	1 hr 52 min			7	2	1 3/4
W-4-M-12	4 1/2″	4 1/4″ × 2 1/2″ Leicester red, wire-cut brick (4465 psi) in 1/2″ sand mortar.	N/A	1 hr 56 min			7	6	1 3/4
W-4-M-13	4 1/4″	4 1/4″ × 2 1/2″ stairfoot brick (7527 psi) 1/2″ sand mortar.	N/A	1 hr 37 min			7	2	1 1/2
W-4-M-14	4 1/4″	4 1/4″ × 2 1/2″ sand-lime brick (2603 psi) 1/2″ sand mortar.	N/A	2 hrs 6 min			7	2	2
W-4-M-15	4 1/4″	4 1/4″ × 2 1/2″ concrete brick (2527 psi) 1/2″ sand mortar.	N/A	2 hrs 10 min			7	2	2
W-4-M-16	4 1/2″	4″ thick clay tile; Ohio fire clay; single cell thick; no plaster exposed face; 1/2″ 1:2 gypsum back face; design “F,” construction “S.”	N/A	31 min			2	3–6, 36	1/2
W-4-M-17	4 1/2″	4″ thick clay tile; Ohio fire clay; single cell thick; plaster exposed face; 1/2″ 1:2 sanded gypsum; back face: none; construction “S,” design “F.”	80 psi	50 min			2	3–5, 8, 36	3/4
W-4-M-18	4 1/2″	Core: solid sand-lime brick; 1/2″ sanded gypsum plaster facings on both sides.	80 psi	3 hrs		1		1, 11	3
W-4-M-19	4 1/2″	Core: solid sand-lime brick; 1/2″ sanded gypsum plaster facings on both sides.	80 psi	2 hrs 30 min		1		1, 11	2 1/2
W-4-M-20	4 1/2″	Core: concrete brick 1/2″ of 1:3 sanded gypsum plaster facings on both sides.	80 psi	2 hrs		1		1, 11	2
W-4-M-21	4 1/2″	Core: solid clay or shale brick; 1/2″ thick, 1:3 sanded gypsum plaster facings on fire sides.	80 psi	1 hr 45 min		1		1, 2, 11	1 3/4
W-4-M-22	4 3/4″	4″ thick clay tile; Ohio fire clay; single cell thick; cells filled with cement and broken tile concrete; plaster on exposed face; none on unexposed face; 3/4″ 1:3 sanded gypsum; design “G,” construction “E.”	N/A	1 hr 48 min			2	2, 3–5, 9, 36	1 3/4
W-4-M-23	4 3/4″	4″ thick clay tile; Ohio fire clay; single cell thick; cells filled with cement and broken tile concrete; no plaster exposed faced; 3/4″ neat gypsum plaster on unexposed face; design “G,” construction “E.”	N/A	2 hrs 14 min			2	2, 3–5, 9, 36	2
W-5-M-24	5″	3″ × 13″ air space; 1″ thick metal reinforced concrete facings on both sides; faces connected with wood splines.	2,250 lbs/ft	45 min		1		1	3/4
W-5-M-25	5″	Core: 3″ thick void filled with “nondulated” mineral wool weighing 10 lbs/ft^3; 1″ thick metal reinforced concrete facings on both sides.	2,250 lbs/ft	2 hrs		1		1	2
W-5-M-26	5″	Core: solid clay or shale brick; 1/2″ thick, 1:3 sanded gypsum plaster facings on both sides.	40 psi	2 hrs 30 min		1		1, 2, 11	2 1/2
W-5-M-27	5″	Core: solid 4″ thick gypsum blocks, laid in 1:3 sanded gypsum mortar; 1/2″ of 1:3 sanded gypsum plaster facings on both sides.	N/A	3 hrs		1		1	3
W-5-M-28	5″	Core: 4″ thick hollow gypsum blocks with 30% voids; blocks laid in 1:3 sanded gypsum mortar; no facings.	N/A	4 hrs		1		1	4
W-5-M-29	5″	Core: concrete brick; 1/2″ of 1:3 sanded gypsum plaster facings on both sides.	160 psi	3 hrs		1		1	3
W-5-M-30	5 1/4″	4″ thick clay tile; Illinois surface clay; double cell thick; plaster: 5/8″ sanded gypsum 1:3 both faces; design “D,” construction “S.”	N/A	2 hrs 53 min			2	2–5, 9, 36	2 3/4
W-5-M-31	5 1/4″	4″ thick clay tile; New Jersey fire clay; double cell thick; plaster: 5/8″ sanded gypsum 1:3 both faces; design “D,” construction “S.”	N/A	1 hr 52 min			2	2–5, 9, 36	1 3/4
W-5-M-32	5 1/4″	4″ thick clay tile; New Jersey fire clay; single cell thick; plaster: 5/8″ sanded gypsum 1:3 both faces; design “D,” construction “S.”	N/A	1 hr 34 min	2		2	2–5, 9, 36	1 1/2

TABLE 1.1.2—continued
MASONRY WALLS
4″ TO LESS THAN 6″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-5-M-33	5 1/4″	4″ thick clay tile; New Jersey fire clay; single cell thick; face plaster: 5/8″ both sides; 1:3 sanded gypsum; design “B,” construction “S.”	N/A	50 min			2	3–5, 8, 36	3/4
W-5-M-34	5 1/4″	4″ thick clay tile; Ohio fire clay; single cell thick; face plaster: 5/8″ both sides; 1:3 sanded gypsum; design “B,” construction “A.”	N/A	1 hr 19 min			2	2–5, 9, 36	1 1/4
W-5-M-35	5 1/4″	4″ thick clay tile; Illinois surface clay; single cell thick; face plaster: 5/8″ both sides; 1:3 sanded gypsum; design “B,” construction “S.”	N/A	1 hr 59 min			2	2–5, 10 36	1 3/4
W-4-M-36	4″	Core: structural clay tile; see Notes 12, 16, 21; no facings.	N/A	15 min		1		3, 4, 24	1/4
W-4-M-37	4″	Core: structural clay tile; see Notes 12, 17, 21; no facings.	N/A	25 min		1		3, 4, 24	1/3
W-4-M-38	4″	Core: structural clay tile; see Notes 12, 16, 20; no facings.	N/A	10 min		1		3, 4, 24	1/6
W-4-M-39	4″	Core: structural clay tile; see Notes 12, 17, 20; no facings.	N/A	20 min		1		3, 4, 24	1/3
W-4-M-40	4″	Core: structural clay tile; see Notes 13, 16, 23; no facings.	N/A	30 min		1		3, 4, 24	1/2
W-4-M-41	4″	Core: structural clay tile; see Notes 13, 17, 23; no facings.	N/A	35 min		1		3, 4, 24	1/2
W-4-M-42	4″	Core: structural clay tile; see Notes 13, 16, 21; no facings.	N/A	25 min		1		3, 4, 24	1/3
W-4-M-43	4″	Core: structural clay tile; see Notes 13, 17, 21; no facings.	N/A	30 min		1		3, 4, 24	1/2
W-4-M-44	4″	Core: structural clay tile; see Notes 15, 16, 20; no facings.	N/A	1 hr 15 min		1		3, 4, 24	1 1/4
W-4-M-45	4″	Core: structural clay tile; see Notes 15, 17, 20; no facings.	N/A	1 hr 15 min		1		3, 4, 24	1 1/4
W-4-M-46	4″	Core: structural clay tile; see Notes 14, 16, 22; no facings.	N/A	20 min		1		3, 4, 24	1/3
W-4-M-47	4″	Core: structural clay tile; see Notes 14, 17, 22; no facings.	N/A	25 min		1		3, 4, 24	1/3
W-4-M-48	4 1/4″	Core: structural clay tile; see Notes 12, 16, 21; facings: both sides; see Note 18.	N/A	45 min		1		3, 4, 24	3/4
W-4-M-49	4 1/4″	Core: structural clay tile; see Notes 12, 17, 21; facings: both sides; see Note 18.	N/A	1 hr		1		3, 4, 24	1
W-4-M-50	4 5/8″	Core: structural clay tile; see Notes 12, 16, 21; facings: unexposed side only; see Note 18.	N/A	25 min		1		3, 4, 24	1/3
W-4-M-51	4 5/8″	Core: structural clay tile; see Notes 12, 17, 21; facings: unexposed side only; see Note 18.	N/A	30 min		1		3, 4, 24	1/2
W-4-M-52	4 5/8″	Core: structural clay tile; see Notes 12, 16, 21; facings: unexposed side only; see Note 18.	N/A	45 min		1		3, 4, 24	3/4
W-4-M-53	4 5/8″	Core: structural clay tile; see Notes 12, 17, 21; facings: fire side only; see Note 18.	N/A	1 hr		1		3, 4, 24	1
W-4-M-54	4 5/8″	Core: structural clay tile; see Notes 12, 16, 20; facings: unexposed side; see Note 18.	N/A	20 min		1		3, 4, 24	1/3
W-4-M-55	4 5/8″	Core: structural clay tile; see Notes 12, 17, 20; facings: exposed side; see Note 18.	N/A	25 min		1		3, 4, 24	1/3
W-4-M-56	4 5/8″	Core: structural clay tile; see Notes 12, 16, 20; facings: fire side only; see Note 18.	N/A	30 min		1		3, 4, 24	1/2
W-4-M-57	4 5/8″	Core: structural clay tile; see Notes 12, 17, 20; facings: fire side only; see Note 18.	N/A	45 min		1		3, 4, 24	3/4
W-4-M-58	4 5/8″	Core: structural clay tile; see Notes 13, 16, 23; facings: unexposed side only; see Note 18.	N/A	40 min		1		3, 4, 24	2/3

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TABLE 1.1.2—continued
MASONRY WALLS
4″ TO LESS THAN 6″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-M-59	4 5/8″	Core: structural clay tile; see Notes 13, 17, 23; facings: unexposed side only; see Note 18.	N/A	1 hr		1		3, 4, 24	1
W-4-M-60	4 5/8″	Core: structural clay tile; see Notes 13, 16, 23; facings: fire side only; see Note 18.	N/A	1 hr 15 min		1		3, 4, 24	1 1/4
W-4-M-61	4 5/8″	Core: structural clay tile; see Notes 13, 17, 23; facings: fire side only; see Note 18.	N/A	1 hr 30 min		1		3, 4, 24	1 1/2
W-4-M-62	4 5/8″	Core: structural clay tile; see Notes 13, 16, 21; facings: unexposed side only; see Note 18.	N/A	35 min		1		3, 4, 24	1/2
W-4-M-63	4 5/8″	Core: structural clay tile; see Notes 13, 17, 21; facings: unexposed face only; see Note 18.	N/A	45 min		1		3, 4, 24	3/4
W-4-M-64	4 5/8″	Core: structural clay tile; see Notes 13, 16, 23; facings: exposed face only; see Note 18.	N/A	1 hr		1		3, 4, 24	1
W-4-M-65	4 5/8″	Core: structural clay tile; see Notes 13, 17, 21; facings: exposed side only; see Note 18.	N/A	1 hr 15 min		1		3, 4, 24	1 1/4
W-4-M-66	4 5/8″	Core: structural clay tile; see Notes 15, 17, 20; facings: unexposed side only; see Note 18	N/A	1 hr 30 min		1		3, 4, 24	1 1/2
W-4-M-67	4 5/8″	Core: structural clay tile; see Notes 15, 16, 20; facings: exposed side only; see Note 18.	N/A	1 hr 45 min		1		3, 4, 24	1 3/4
W-4-M-68	4 5/8″	Core: structural clay tile; see Notes 15, 17, 20; facings: exposed side only; see Note 18.	N/A	1 hr 45 min		1		3, 4, 24	1 3/4
W-4-M-69	4 5/8″	Core: structural clay tile; see Notes 15, 16, 20; facings: unexposed side only; see Note 18.	N/A	1 hr 30 min		1		3, 4, 24	1 1/2
W-4-M-70	4 5/8″	Core: structural clay tile; see Notes 14, 16, 22; facings: unexposed side only; see Note 18.	N/A	30 min		1		3, 4, 24	1/2
W-4-M-71	4 5/8″	Core: structural clay tile; see Notes 14, 17, 22; facings: exposed side only; see Note 18.	N/A	35 min		1		3, 4, 24	1/2
W-4-M-72	4 5/8″	Core: structural clay tile; see Notes 14, 16, 22; facings: fire side of wall only; see Note 18.	N/A	45 min		1		3, 4, 24	3/4
W-4-M-73	4 5/8″	Core: structural clay tile; see Notes 14, 17, 22; facings: fire side of wall only; see Note 18.	N/A	1 hr		1		3, 4, 24	1
W-5-M-74	5 1/4″	Core: structural clay tile; see Notes 12, 16, 21; facings: both sides; see Note 18.	N/A	1 hr		1		3, 4, 24	1
W-5-M-75	5 1/4″	Core: structural clay tile; see Notes 12, 17, 21; facings: both sides; see Note 18.	N/A	1 hr 15 min		1		3, 4, 24	1 1/4
W-5-M-76	5 1/4″	Core: structural clay tile; see Notes 12, 16, 20; facings: both sides; see Note 18.	N/A	45 min		1		3, 4, 24	3/4
W-5-M-77	5 1/4″	Core: structural clay tile; see Notes 12, 17, 20; facings: both sides; see Note 18.	N/A	1 hr		1		3, 4, 24	1
W-5-M-78	5 1/4″	Core: structural clay tile; see Notes 13, 16, 23; facings: both sides of wall; see Note 18.	N/A	1 hr 30 min		1		3, 4, 24	1 1/2
W-5-M-79	5 1/4″	Core: structural clay tile; see Notes 13, 17, 23; facings: both sides of wall; see Note 18.	N/A	2 hrs		1		3, 4, 24	2
W-5-M-80	5 1/4″	Core: structural clay tile; see Notes 13, 16, 21; facings: both sides of wall; see Note 18.	N/A	1 hr 15 min		1		3, 4, 24	1 1/4
W-5-M-81	5 1/4″	Core: structural clay tile; see Notes 13, 16, 21; facings: both sides of wall; see Note 18.	N/A	1 hr 30 min		1		3, 4, 24	1 1/2
W-5-M-82	5 1/4″	Core: structural clay tile; see Notes 15, 16, 20; facings: both sides; see Note 18.	N/A	2 hrs 30 min		1		3, 4, 24	2 1/2
W-5-M-83	5 1/4″	Core: structural clay tile; see Notes 15, 17, 20; facings: both sides; see Note 18.	N/A	2 hrs 30 min		1		3, 4, 24	2 1/2
W-5-M-84	5 1/4″	Core: structural clay tile; see Notes 14, 16, 22; facings: both sides of wall; see Note 18.	N/A	1 hr 15 min		1		3, 4, 24	1 1/4
W-5-M-85	5 1/4″	Core: structural clay tile; see Notes 14, 17, 22; facings: both sides of wall; see Note 18.	N/A	1 hr 30 min		1		3, 4, 24	1 1/2
W-4-M-86	4″	Core: 3″ thick gypsum blocks 70% solid; see Note 26; facings: both sides; see Note 25.	N/A	2 hrs		1			2

TABLE 1.1.2—continued
MASONRY WALLS
4″ TO LESS THAN 6″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-M-87	4″	Core: hollow concrete units; see Notes 27, 34, 35; no facings.	N/A	1 hr 30 min		1			1 1/2
W-4-M-88	4″	Core: hollow concrete units; see Notes 28, 33, 35; no facings.	N/A	1 hr		1			1
W-4-M-89	4″	Core: hollow concrete units; see Notes 28, 34, 35; facings: both sides; see Note 25.	N/A	1 hr 45 min		1			1 3/4
W-4-M-90	4″	Core: hollow concrete units; see Notes 27, 34, 35; facings: both sides; see Note 25.	N/A	2 hrs		1			2
W-4-M-91	4″	Core: hollow concrete units; see Notes 27, 32, 35; no facings.	N/A	1 hr 15 min		1			1 1/4
W-4-M-92	4″	Core: hollow concrete units; see Notes 28, 34, 35; no facings.	N/A	1 hr 15 min		1			1 1/4
W-4-M-93	4″	Core: hollow concrete units; see Notes 29, 32, 35; no facings.	N/A	20 min		1			1/3
W-4-M-94	4″	Core: hollow concrete units; see Notes 30, 34, 35; no facings.	N/A	15 min		1			1/4
W-4-M-95	4 1/2″	Core: hollow concrete units; see Notes 27, 34, 35; facings: one side only; see Note 25.	N/A	2 hrs		1			2
W-4-M-96	4 1/2″	Core: hollow concrete units; see Notes 27, 32, 35; facings: one side only; see Note 25.	N/A	1 hr 45 min		1			1 3/4
W-4-M-97	4 1/2″	Core: hollow concrete units; see Notes 28, 33, 35; facings: one side; see Note 25.	N/A	1 hr 30 min		1			1 1/2
W-4-M-98	4 1/2″	Core: hollow concrete units; see Notes 28, 34, 35; facings: one side only; see Note 25.	N/A	1 hr 45 min		1			1 3/4
W-4-M-99	4 1/2″	Core: hollow concrete units; see Notes 29, 32, 35; facings: one side; see Note 25.	N/A	30 min		1			1/2
W-4-M-100	4 1/2″	Core: hollow concrete units; see Notes 30, 34, 35; facings: one side; see Note 25.	N/A	20 min		1			1/3
W-5-M-101	5″	Core: hollow concrete units; see Notes 27, 34, 35; facings: both sides; see Note 25.	N/A	2 hrs 30 min		1			2 1/2
W-5-M-102	5″	Core: hollow concrete units; see Notes 27, 32, 35; facings: both sides; see Note 25.	N/A	2 hrs 30 min		1			2 1/2
W-5-M-103	5″	Core: hollow concrete units; see Notes 28, 33, 35; facings: both sides; see Note 25.	N/A	2 hrs		1			2
W-5-M-104	5″	Core: hollow concrete units; see Notes 28, 31, 35; facings: both sides; see Note 25.	N/A	2 hrs		1			2
W-5-M-105	5″	Core: hollow concrete units; see Notes 29, 32, 35; facings: both sides; see Note 25.	N/A	1 hr 45 min		1			1 3/4
W-5-M-106	5″	Core: hollow concrete units; see Notes 30, 34, 35; facings: both sides; see Note 25.	N/A	1 hr		1			1
W-5-M-107	5″	Core: 5″ thick solid gypsum blocks; see Note 26; no facings.	N/A	4 hrs		1			4
W-5-M-108	5″	Core: 4″ thick hollow gypsum blocks; see Note 26; facings: both sides; see Note 25.	N/A	3 hrs		1			3
W-4-M-109	4″	Concrete with 4″ × 4″ No. 6 welded wire mesh at wall center.	100 psi	45 min			43	2	3/4
W-4-M-110	4″	Concrete with 4″ × 4″ No. 6 welded wire mesh at wall center.	N/A	1 hr 15 min			43	2	1 1/4

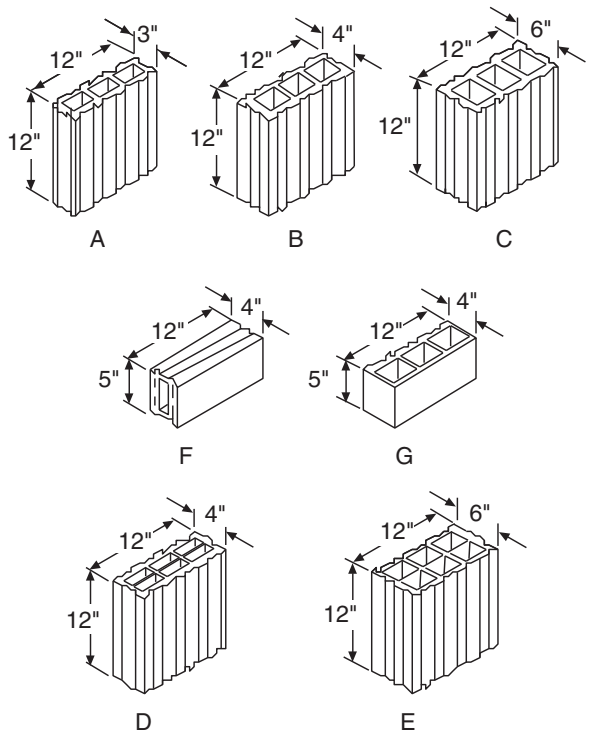
For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

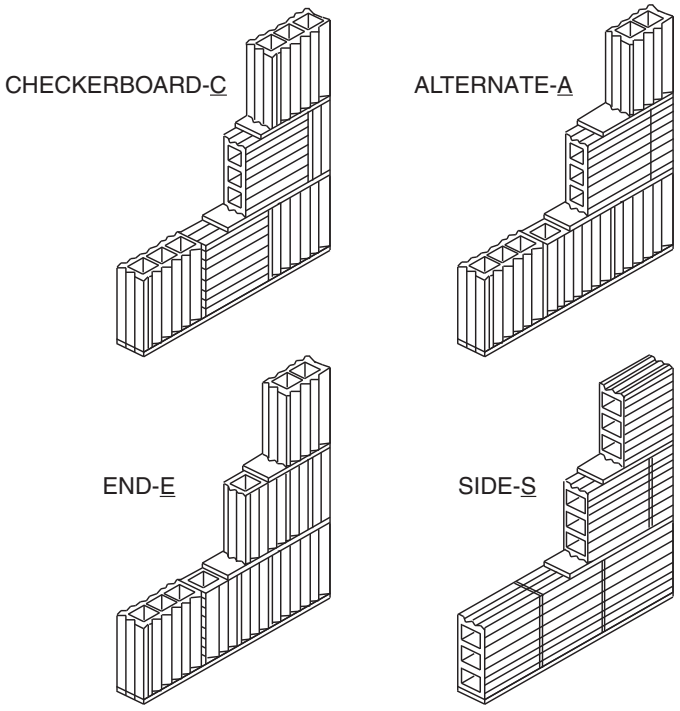
1. Tested as NBS under ASA Spec. No. A 2-1934.
2. Failure mode—maximum temperature rise.
3. Treated at NBS under ASA Spec. No. 42-1934 (ASTM C19-53) except that hose stream testing where carried out was run on test specimens exposed for full test duration, not for a reduced period as is contemporarily done.
4. For clay tile walls, unless the source the clay can be positively identified, it is suggested that the most pessimistic hour rating for the fire endurance of a clay tile partition of that thickness be followed. Identified sources of clay showing longer fire endurance can lead to longer time recommendations.

TABLE 1.1.2—continued
MASONRY WALLS
4″ TO LESS THAN 6″ THICK

5. See appendix for construction and design details for clay tile walls.
6. Failure mode—flame thru or crack formation showing flames.
7. Hole formed at 25 minutes; partition collapsed at 42 minutes on removal from furnace.
8. Failure mode—collapse.
9. Hose stream pass.
10. Hose stream hole formed in specimen.
11. Load: 80 psi for gross wall cross-sectional area.
12. One cell in wall thickness.
13. Two cells in wall thickness.
14. Double cells plus one cell in wall thickness.
15. One cell in wall thickness, cells filled with broken tile, crushed stone, slag, cinders or sand mixed with mortar.
16. Dense hard-burned clay or shale tile.
17. Medium-burned clay tile.
18. Not less than $^{5}/_{8}$ inch thickness of 1:3 sanded gypsum plaster.
19. Units of not less than 30 percent solid material.
20. Units of not less than 40 percent solid material.
21. Units of not less than 50 percent solid material.
22. Units of not less than 45 percent solid material.
23. Units of not less than 60 percent solid material.
24. All tiles laid in Portland cement-lime mortar.
25. Minimum $^{1}/_{2}$ inch—1:3 sanded gypsum plaster.
26. Laid in 1:3 sanded gypsum mortar. Voids in hollow units not to exceed 30 percent.
27. Units of expanded slag or pumice aggregate.
28. Units of crushed limestone, blast furnace slag, cinders and expanded clay or shale.
29. Units of calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.
30. Units of siliceous sand and gravel. Ninety percent or more quartz, chert or flint.
31. Unit at least 49 percent solid.
32. Unit at least 62 percent solid.
33. Unit at least 65 percent solid.
34. Unit at least 73 percent solid.
35. Ratings based on one unit and one cell in wall thickness.
36. See clay tile partition design construction drawings below.



DESIGNS OF TILES USED IN FIRE-TEST PARTITIONS



THE FOUR TYPES OF CONSTRUCTION USED IN FIRE-TEST PARTITIONS

FIGURE 1.1.3
MASONRY WALLS
6″ TO LESS THAN 8″ THICK

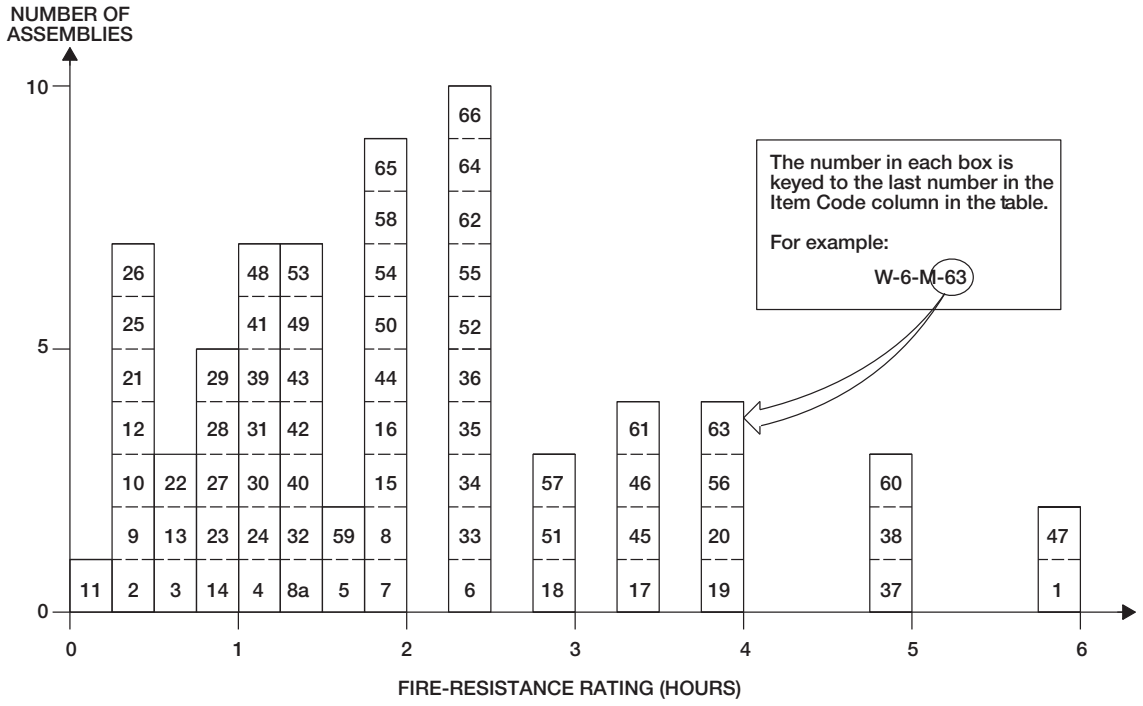


TABLE 1.1.3
MASONRY WALLS
6″ TO LESS THAN 8″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-6-M-1	6″	Core: 5″ thick, solid gypsum blocks laid in 1:3 sanded gypsum mortar; $^1/_2$″ of 1:3 sanded gypsum plaster facings on both sides.	N/A	6 hrs		1			6
W-6-M-2	6″	6″ clay tile; Ohio fire clay; single cell thick; no plaster; design “C,” construction “A.”	N/A	17 min			2	1, 3, 4, 6, 55	$^1/_4$
W-6-M-3	6″	6″ clay tile; Illinois surface clay; double cell thick; no plaster; design “E,” construction “C.”	N/A	45 min			2	1–4, 7, 55	$^3/_4$
W-6-M-4	6″	6″ clay tile; New Jersey fire clay; double cell thick; no plaster; design “E,” construction “S.”	N/A	1 hr 1 min			2	1–4, 8, 55	1
W-7-M-5	$7^1/_4$″	6″ clay tile; Illinois surface clay; double cell thick; plaster: $^5/_8$″—1:3 sanded gypsum both faces; design “E,” construction “A.”	N/A	1 hr 41 min			2	1–4, 55	$1^2/_3$
W-7-M-6	$7^1/_4$″	6″ clay tile; New Jersey fire clay; double cell thick; plaster: $^5/_8$″—1:3 sanded gypsum both faces; design “E,” construction “S.”	N/A	2 hrs 23 min			2	1–4, 9, 55	$2^1/_3$
W-7-M-7	$7^1/_4$″	6″ clay tile; Ohio fire clay; single cell thick; plaster: $^5/_8$″ sanded gypsum, 1:3 both faces; design “C,” construction “A.”	N/A	1 hr 54 min			2	1–4, 9, 55	$2^3/_4$
W-7-M-8	$7^1/_4$″	6″ clay tile; Illinois surface clay; single cell thick; plaster: $^5/_8$″ sanded gypsum, 1:3 both faces; design “C,” construction “S.”	N/A	2 hrs			2	1, 3, 4, 9, 10, 55	2
W-7-M-8a	$7^1/_4$″	6″ clay tile; Illinois surface clay; single cell thick; plaster: $^5/_8$″ sanded gypsum, 1:3 both faces; design “C,” construction “E.”	N/A	1 hr 23 min			2	1–4, 9, 10, 55	$1^1/_4$
W-6-M-9	6″	Core: structural clay tile; see Notes 12, 16, 20; no facings.	N/A	20 min		1		3, 5, 24	$^1/_3$
W-6-M-10	6″	Core: structural clay tile; see Notes 12, 17, 20; no facings.	N/A	25 min		1		3, 5, 24	$^1/_3$

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TABLE 1.1.3—continued
MASONRY WALLS
6″ TO LESS THAN 8″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-6-M-11	6″	Core: structural clay tile; see Notes 12, 16, 19; no facings.	N/A	15 min		1		3, 5, 24	1/4
W-6-M-12	6″	Core: structural clay tile; see Notes 12, 17, 19; no facings.	N/A	20 min		1		3, 5, 24	1/3
W-6-M-13	6″	Core: structural clay tile; see Notes 13, 16, 22; no facings.	N/A	45 min		1		3, 5, 24	3/4
W-6-M-14	6″	Core: structural clay tile; see Notes 13, 17, 22; no facings.	N/A	1 hr		1		3, 5, 24	1
W-6-M-15	6″	Core: structural clay tile; see Notes 15, 17, 19; no facings.	N/A	2 hrs		1		3, 5, 24	2
W-6-M-16	6″	Core: structural clay tile; see Notes 15, 16, 19; no facings.	N/A	2 hrs		1		3, 5, 24	2
W-6-M-17	6″	Cored concrete masonry; see Notes 12, 34, 36, 38, 41; no facings.	80 psi	3 hrs 30 min		1		5, 25	3 1/2
W-6-M-18	6″	Cored concrete masonry; see Notes 12, 33, 36, 38, 41; no facings.	80 psi	3 hrs		1		5, 25	3
W-6-M-19	6 1/2″	Cored concrete masonry; see Notes 12, 34, 36, 38, 41; facings: side 1; see Note 35.	80 psi	4 hrs		1		5, 25	4
W-6-M-20	6 1/2″	Cored concrete masonry; see Notes 12, 33, 36, 38, 41; facings: side 1; see Note 35.	80 psi	4 hrs		1		5, 25	4
W-6-M-21	6 5/8″	Core: structural clay tile; see Notes 12, 16, 20; facings: unexposed face only; see Note 18.	N/A	30 min		1		3, 5, 24	1/2
W-6-M-22	6 5/8″	Core: structural clay tile; see Notes 12, 17, 20; facings: unexposed face only; see Note 18.	N/A	40 min		1		3, 5, 24	2/3
W-6-M-23	6 5/8″	Core: structural clay tile; see Notes 12, 16, 20; facings: exposed face only; see Note 18.	N/A	1 hr		1		3, 5, 24	1
W-6-M-24	6 5/8″	Core: structural clay tile; see Notes 12, 17, 20; facings: exposed face only; see Note 18.	N/A	1 hr 5 min		1		3, 5, 24	1
W-6-M-25	6 5/8″	Core: structural clay tile; see Notes 12, 16, 19; facings: unexposed side only; see Note 18.	N/A	25 min		1		3, 5, 24	1/3
W-6-M-26	6 5/8″	Core: structural clay tile; see Notes 12, 17, 19; facings: unexposed face only; see Note 18.	N/A	30 min		1		3, 5, 24	1/2
W-6-M-27	6 5/8″	Core: structural clay tile; see Notes 12, 16, 19; facings: exposed side only; see Note 18.	N/A	1 hr		1		3, 5, 24	1
W-6-M-28	6 5/8″	Core: structural clay tile; see Notes 12, 17, 19; facings: fire side only; see Note 18.	N/A	1 hr		1		3, 5, 24	1
W-6-M-29	6 5/8″	Core: structural clay tile; see Notes 13, 16, 22; facings: unexposed side only; see Note 18.	N/A	1 hr		1		3, 5, 24	1
W-6-M-30	6 5/8″	Core: structural clay tile; see Notes 13, 17, 22; facings: unexposed side only; see Note 18.	N/A	1 hr 15 min		1		3, 5, 24	1 1/4
W-6-M-31	6 5/8″	Core: structural clay tile; see Notes 13, 16, 22; facings: fire side only; see Note 18.	N/A	1 hr 15 min		1		3, 5, 24	1 1/4
W-6-M-32	6 5/8″	Core: structural clay tile; see Notes 13, 17, 22; facings: fire side only; see Note 18.	N/A	1 hr 30 min		1		3, 5, 24	1 1/2
W-6-M-33	6 5/8″	Core: structural clay tile; see Notes 15, 16, 19; facings: unexposed side only; see Note 18.	N/A	2 hrs 30 min		1		3, 5, 24	2 1/2
W-6-M-34	6 5/8″	Core: structural clay tile; see Notes 15, 17, 19; facings: unexposed side only; see Note 18.	N/A	2 hrs 30 min		1		3, 5, 24	2 1/2
W-6-M-35	6 5/8″	Core: structural clay tile; see Notes 15, 16, 19; facings: fire side only; see Note 18.	N/A	2 hrs 30 min		1		3, 5, 24	2 1/2
W-6-M-36	6 5/8″	Core: structural clay tile; see Notes 15, 17, 19; facings: fire side only; see Note 18.	N/A	2 hrs 30 min		1		3, 5, 24	2 1/2
W-7-M-37	7″	Cored concrete masonry; see Notes 12, 34, 36, 38, 41; see Note 35 for facings on both sides.	80 psi	5 hrs		1		5, 25	5
W-7-M-38	7″	Cored concrete masonry; see Notes 12, 33, 36, 38, 41; see Note 35 for facings.	80 psi	5 hrs		1		5, 25	5

TABLE 1.1.3—continued
MASONRY WALLS
6″ TO LESS THAN 8″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-7-M-39	7 1/4″	Core: structural clay tile; see Notes 12, 16, 20; facings: both sides; see Note 18.	N/A	1 hr 15 min		1		3, 5, 24	1 1/4
W-7-M-40	7 1/4″	Core: structural clay tile; see Notes 12, 17, 20; facings: both sides; see Note 18.	N/A	1 hr 30 min		1		3, 5, 24	1 1/2
W-7-M-41	7 1/4″	Core: structural clay tile; see Notes 12, 16, 19; facings: both sides; see Note 18.	N/A	1 hr 15 min		1		3, 5, 24	1 1/4
W-7-M-42	7 1/4″	Core: structural clay tile; see Notes 12, 17, 19; facings: both sides; see Note 18.	N/A	1 hr 30 min		1		3, 5, 24	1 1/2
W-7-M-43	7 1/4″	Core: structural clay tile; see Notes 13, 16, 22; facings: both sides of wall; see Note 18.	N/A	1 hr 30 min		1		3, 5, 24	1 1/2
W-7-M-44	7 1/4″	Core: structural clay tile; see Notes 13, 17, 22; facings: both sides of wall; see Note 18.	N/A	2 hrs		1		3, 5, 24	2
W-7-M-45	7 1/4″	Core: structural clay tile; see Notes 15, 16, 19; facings: both sides; see Note 18.	N/A	3 hrs 30 min		1		3, 5, 24	3 1/2
W-7-M-46	7 1/4″	Core: structural clay tile; see Notes 15, 17, 19; facings: both sides; see Note 18.	N/A	3 hrs 30 min		1		3, 5, 24	3 1/2
W-6-M-47	6″	Core: 5″ thick solid gypsum blocks; see Note 45; facings: both sides; see Note 35.	N/A	6 hrs		1			6
W-6-M-48	6″	Core: hollow concrete units; see Notes 47, 50, 54; no facings.	N/A	1 hr 15 min		1			1 1/4
W-6-M-49	6″	Core: hollow concrete units; see Notes 46, 50, 54; no facings.	N/A	1 hr 30 min		1			1 1/2
W-6-M-50	6″	Core: hollow concrete units; see Notes 41, 46, 54; no facings.	N/A	2 hrs		1			2
W-6-M-51	6″	Core: hollow concrete units; see Notes 46, 53, 54; no facings.	N/A	3 hrs		1			3
W-6-M-52	6″	Core: hollow concrete units; see Notes 47, 53, 54; no facings.	N/A	2 hrs 30 min		1			2 1/2
W-6-M-53	6″	Core: hollow concrete units; see Notes 47, 51, 54; no facings.	N/A	1 hr 30 min		1			1 1/2
W-6-M-54	6 1/2″	Core: hollow concrete units; see Notes 46, 50, 54; facings: one side only; see Note 35.	N/A	2 hrs		1			2
W-6-M-55	6 1/2″	Core: hollow concrete units; see Notes 46, 51, 54; facings: one side; see Note 35.	N/A	2 hrs 30 min		1			2 1/2
W-6-M-56	6 1/2″	Core: hollow concrete units; see Notes 46, 53, 54; facings: one side; see Note 35.	N/A	4 hrs		1			4
W-6-M-57	6 1/2″	Core: hollow concrete units; see Notes 47, 53, 54; facings: one side; see Note 35.	N/A	3 hrs		1			3
W-6-M-58	6 1/2″	Core: hollow concrete units; see Notes 47, 51, 54; facings: one side; see Note 35.	N/A	2 hrs		1			2
W-6-M-59	6 1/2″	Core: hollow concrete units; see Notes 47, 50, 54; facings: one side; see Note 35.	N/A	1 hr 45 min		1			1 3/4
W-7-M-60	7″	Core: hollow concrete units; see Notes 46, 53, 54; facings: both sides; see Note 35.	N/A	5 hrs		1			5
W-7-M-61	7″	Core: hollow concrete units; see Notes 46, 51, 54; facings: both sides; see Note 35.	N/A	3 hrs 30 min		1			3 1/2
W-7-M-62	7″	Core: hollow concrete units; see Notes 46, 50, 54; facings: both sides; see Note 35.	N/A	2 hrs 30 min		1			2 1/2
W-7-M-63	7″	Core: hollow concrete units; see Notes 47, 53, 54; facings: both sides; see Note 35.	N/A	4 hrs		1			4
W-7-M-64	7″	Core: hollow concrete units; see Notes 47, 51, 54; facings: both sides; see Note 35.	N/A	2 hrs 30 min		1			2 1/2
W-7-M-65	7″	Core: hollow concrete units; see Notes 47, 50, 54; facings: both sides; see Note 35.	N/A	2 hrs		1			2
W-6-M-66	6″	Concrete wall with 4″ × 4″ No. 6 wire fabric (welded) near wall center for reinforcement.	300 psi	2 hrs 30 min			43	2	2 1/2

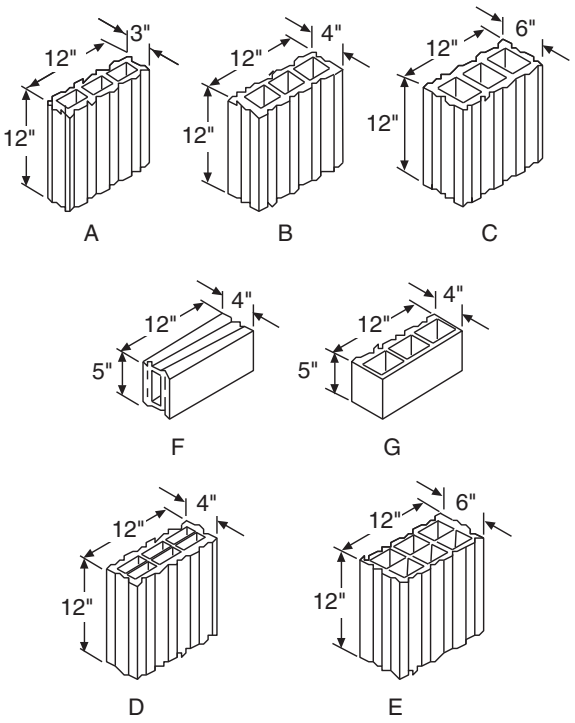
TABLE 1.1.3—continued
MASONRY WALLS
6″ TO LESS THAN 8″ THICK

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

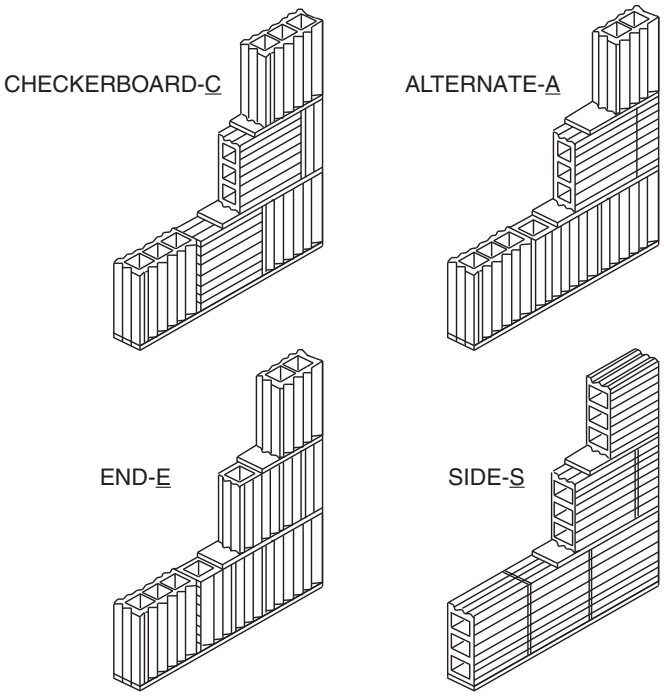
Notes:

1. Tested at NBS under ASA Spec. No. 43-1934 (ASTM C19-53), except that hose stream testing where carried out was run on test specimens exposed for full test duration, not for a reduced period as is contemporarily done.
2. Failure by thermal criteria—maximum temperature rise.
3. For clay tile walls, unless the source or density of the clay can be positively identified or determined, it is suggested that the lowest hourly rating for the fire endurance of a clay tile partition of that thickness be followed. Identified sources of clay showing longer fire endurance can lead to longer time recommendations.
4. See Note 55 for construction and design details for clay tile walls.
5. Tested at NBS under ASA Spec. No. A2-1934.
6. Failure mode—collapse.
7. Collapsed on removal from furnace at 1 hour 9 minutes.
8. Hose stream—failed.
9. Hose stream—passed.
10. No end point met in test.
11. Wall collapsed at 1 hour 28 minutes.
12. One cell in wall thickness.
13. Two cells in wall thickness.
14. Double shells plus one cell in wall thickness.
15. One cell in wall thickness, cells filled with broken tile, crushed stone, slag, cinders or sand mixed with mortar.
16. Dense hard-burned clay or shale tile.
17. Medium-burned clay tile.
18. Not less than $^{5}/_{8}$ inch thickness of 1:3 sanded gypsum plaster.
19. Units of not less than 30 percent solid material.
20. Units of not less than 40 percent solid material.
21. Units of not less than 50 percent solid material.
22. Units of not less than 45 percent solid material.
23. Units of not less than 60 percent solid material.
24. All tiles laid in Portland cement-lime mortar.
25. Load: 80 psi for gross cross-sectional area of wall.
26. Three cells in wall thickness.
27. Minimum percent of solid material in concrete units = 52.
28. Minimum percent of solid material in concrete units = 54.
29. Minimum percent of solid material in concrete units = 55.
30. Minimum percent of solid material in concrete units = 57.
31. Minimum percent of solid material in concrete units = 62.
32. Minimum percent of solid material in concrete units = 65.
33. Minimum percent of solid material in concrete units = 70.
34. Minimum percent of solid material in concrete units = 76.
35. Not less than $^{1}/_{2}$ inch of 1:3 sanded gypsum plaster.
36. Noncombustible or no members framed into wall.
37. Combustible members framed into wall.
38. One unit in wall thickness.
39. Two units in wall thickness.
40. Three units in wall thickness.
41. Concrete units made with expanded slag or pumice aggregates.
42. Concrete units made with expanded burned clay or shale, crushed limestone, air-cooled slag or cinders.
43. Concrete units made with calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.
44. Concrete units made with siliceous sand and gravel. Ninety percent or more quartz, chert or flint.
45. Laid in 1:3 sanded gypsum mortar.
46. Units of expanded slag or pumice aggregate.
47. Units of crushed limestone, blast furnace, slag, cinder and expanded clay or shale.
48. Units of calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.
49. Units of siliceous sand and gravel. Ninety percent or more quartz, chert or flint.
50. Unit minimum 49 percent solid.
51. Unit minimum 62 percent solid.
52. Unit minimum 65 percent solid.
53. Unit minimum 73 percent solid.
54. Ratings based on one unit and one cell in wall section.
55. See clay tile partition design construction drawings:

TABLE 1.1.3—continued
MASONRY WALL
6" TO LESS THAN 8" THICK



DESIGNS OF TILES USED IN FIRE-TEST PARTITIONS



THE FOUR TYPES OF CONSTRUCTION USED IN FIRE-TEST PARTITIONS

FIGURE 1.1.4
MASONRY WALLS
8² TO LESS THAN 10² THICK

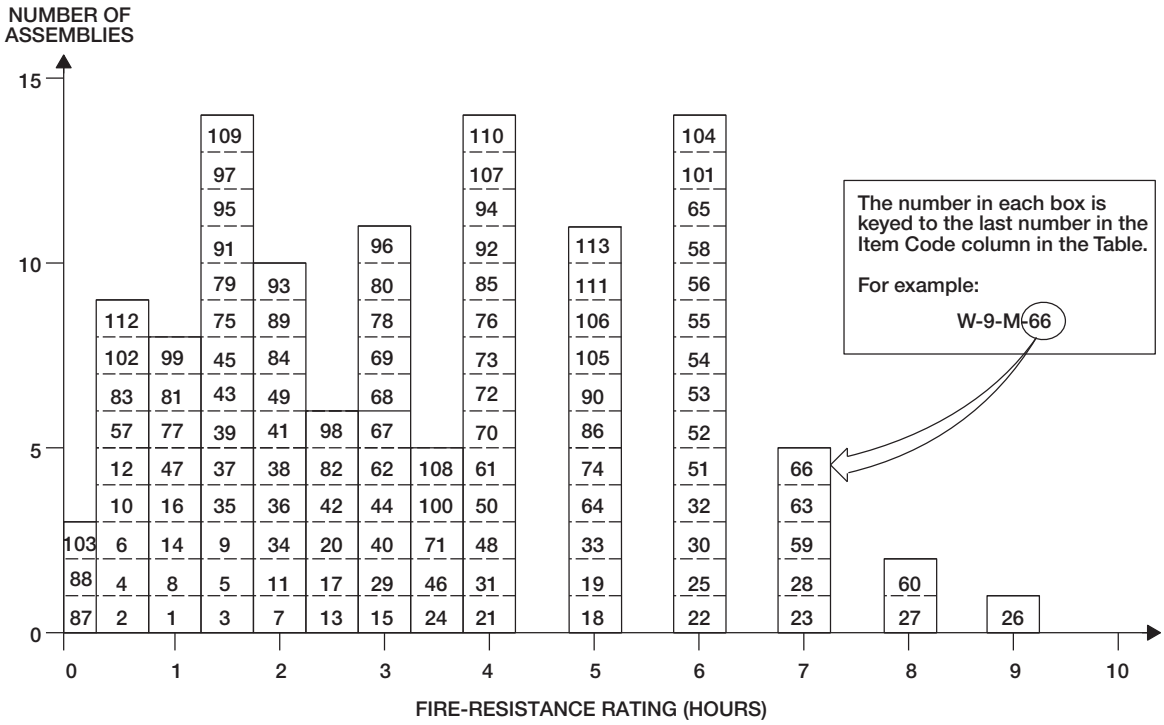


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TABLE 1.1.4
MASONRY WALLS
8″ TO LESS THAN 10″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-8-M-1	8″	Core: clay or shale structural tile; units in wall thickness: 1; cells in wall thickness: 2; minimum % solids in units: 40.	80 psi	1 hr 15 min		1		1, 20	$1^1/_4$
W-8-M-2	8″	Core: clay or shale structural tile; units in wall thickness: 1; cells in wall thickness: 2; minimum % solids in units: 40; no facings; result for wall with combustible members framed into interior.	80 psi	45 min		1		1, 20	$^3/_4$
W-8-M-3	8″	Core: clay or shale structural tile; units in wall thickness: 1; cells in wall thickness: 2; minimum % solids in units: 43.	80 psi	1 hr 30 min		1		1, 20	$1^1/_2$
W-8-M-4	8″	Core: clay or shale structural tile; units in wall thickness: 1; cells in wall thickness: 2; minimum % solids in units: 43; no facings; combustible members framed into wall.	80 psi	45 min		1		1, 20	$^3/_4$
W-8-M-5	8″	Core: clay or shale structural tile; no facings.	See notes	1 hr 30 min		1		1, 2, 5, 10, 18, 20, 21	$1^1/_2$
W-8-M-6	8″	Core: clay or shale structural tile; no facings.	See notes	45 min		1		1, 2, 5, 10,19, 20, 21	$^3/_4$
W-8-M-7	8″	Core: clay or shale structural tile; no facings.	See notes	2 hrs		1		1, 2, 5, 13, 18, 20, 21	2
W-8-M-8	8″	Core: clay or shale structural tile; no facings.	See notes	1 hr 15 min		1		1, 2, 5, 13, 19, 20, 21	$1^1/_4$
W-8-M-9	8″	Core: clay or shale structural tile; no facings.	See notes	1 hr 45 min		1		1, 2, 6, 9, 18, 20, 21	$1^3/_4$
W-8-M-10	8″	Core: clay or shale structural tile; no facings.	See notes	45 min		1		1, 2, 6, 9, 19, 20, 21	$^3/_4$
W-8-M-11	8″	Core: clay or shale structural tile; no facings.	See notes	2 hrs		1		1, 2, 6, 10, 18, 20, 21	2
W-8-M-12	8″	Core: clay or shale structural tile; no facings.	See notes	45 min		1		1, 2, 6, 10, 19, 20, 21	$^3/_4$
W-8-M-13	8″	Core: clay or shale structural tile; no facings.	See notes	2 hrs 30 min		1		1, 3, 6, 12, 18, 20, 21	$2^1/_2$
W-8-M-14	8″	Core: clay or shale structural tile; no facings.	See notes	1 hr		1		1, 2, 6, 12, 19, 20, 21	1
W-8-M-15	8″	Core: clay or shale structural tile; no facings.	See notes	3 hrs		1		1, 2, 6, 16, 18, 20, 21	3
W-8-M-16	8″	Core: clay or shale structural tile; no facings.	See notes	1 hr 15 min		1		1, 2, 6, 16, 19, 20, 21	$1^1/_4$
W-8-M-17	8″	Cored clay or shale brick; units in wall thickness: 1; cells in wall thickness: 1; minimum % solids: 70; no facings.	See notes	2 hrs 30 min		1		1, 44	$2^1/_2$
W-8-M-18	8″	Cored clay or shale brick; units in wall thickness: 2; cells in wall thickness: 2; minimum % solids: 87; no facings.	See notes	5 hrs		1		1, 45	5
W-8-M-19	8″	Core: solid clay or shale brick; no facings.	See notes	5 hrs		1		1, 22, 45	5

TABLE 1.1.4—continued
MASONRY WALLS
8″ TO LESS THAN 10″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-8-M-20	8″	Core: hollow rolok of clay or shale.	See notes	2 hrs 30 min		1		1, 22, 45	$2^1/_2$
W-8-M-21	8″	Core: hollow rolok bak of clay or shale; no facings.	See notes	4 hrs		1		1, 45	4
W-8-M-22	8″	Core: concrete brick; no facings.	See notes	6 hrs		1		1, 45	6
W-8-M-23	8″	Core: sand-lime brick; no facings.	See notes	7 hrs		1		1, 45	7
W-8-M-24	8″	Core: 4″, 40% solid clay or shale structural tile; 1 side 4″ brick facing.	See notes	3 hrs 30 min		1		1, 20	$3^1/_2$
W-8-M-25	8″	Concrete wall (3220 psi); reinforcing vertical rods 1″ from each face and 1″ diameter; horizontal rods $^5/_8$″ diameter.	22,200 lbs/ft	6 hrs			7		6
W-8-M-26	8″	Core: sand-line brick; $^1/_2$″ of 1:3 sanded gypsum plaster facings on one side.	See notes	9 hrs		1		1, 45	9
W-8-M-27	$8^1/_2$″	Core: sand-line brick; $^1/_2$″ of 1:3 sanded gypsum plaster facings on one side.	See notes	8 hrs		1		1, 45	8
W-8-M-28	$8^1/_2$″	Core: concrete; $^1/_2$″ of 1:3 sanded gypsum plaster facings on one side.	See notes	7 hrs		1		1, 45	7
W-8-M-29	$8^1/_2$″	Core: hollow rolok of clay or shale; $^1/_2$″ of 1:3 sanded gypsum plaster facings on one side.	See notes	3 hrs		1		1, 45	3
W-8-M-30	$8^1/_2$″	Core: solid clay or shale brick $^1/_2$″ thick, 1:3 sanded gypsum plaster facings on one side.	See notes	6 hrs		1		1, 22, 45	6
W-8-M-31	$8^1/_2$″	Core: cored clay or shale brick; units in wall thickness: 1; cells in wall thickness: 1; minimum % solids: 70; $^1/_2$″ of 1:3 sanded gypsum plaster facings on both sides.	See notes	4 hrs		1		1, 44	4
W-8-M-32	$8^1/_2$″	Core: cored clay or shale brick; units in wall thickness: 2; cells in wall thickness: 2; minimum % solids: 87; $^1/_2$″ of 1:3 sanded gypsum plaster facings on one side.	See notes	6 hrs		1		1, 45	6
W-8-M-33	$8^1/_2$″	Core: hollow rolok bak of clay or shale; $^1/_2$″ of 1:3 sanded gypsum plaster facings on one side.	See notes	5 hrs		1		1, 45	5
W-8-M-34	$8^5/_8$″	Core: clay or shale structural tile; units in wall thickness: 1; cells in wall thickness: 2; minimum % solids in units: 40; $^5/_8$″ of 1:3 sanded gypsum plaster facings on one side.	See notes	2 hrs		1		1, 20, 21	2
W-8-M-35	$8^5/_8$″	Core: clay or shale structural tile; units in wall thickness: 1; cells in wall thickness: 2; minimum % solids in units: 40; exposed face: $^5/_8$″ of 1:3 sanded gypsum plaster.	See notes	1 hr 30 min		1		1, 20, 21	$1^1/_2$
W-8-M-36	$8^5/_8$″	Core: clay or shale structural tile; units in wall thickness: 1; cells in wall thickness: 2; minimum % solids in units: 43; $^5/_8$″ of 1:3 sanded gypsum plaster facings on one side.	See notes	2 hrs				1, 20, 21	2
W-8-M-37	$8^5/_8$″	Core: clay or shale structural tile; units in wall thickness: 1; cells in wall thickness: 2; minimum % solids in units: 43; $^5/_8$″ of 1:3 sanded gypsum plaster of the exposed face only.	See notes	1 hr 30 min		1		1, 20, 21	$1^1/_2$
W-8-M-38	$8^5/_8$″	Core: clay or shale structural tile; facings: side 1; see Note 17.	See notes	2 hrs		1		1, 2, 5, 10, 18, 20, 21	2
W-8-M-39	$8^5/_8$″	Core: clay or shale structural tile; facings: exposed side only; see Note 17.	See notes	1 hr 30 min		1		1, 2, 5, 10, 19, 20, 21	$1^1/_2$
W-8-M-40	$8^5/_8$″	Core: clay or shale structural tile; facings: exposed side only; see Note 17.	See notes	3 hrs		1		1, 2, 5, 13, 18, 20, 21	3
W-8-M-41	$8^5/_8$″	Core: clay or shale structural tile; facings: exposed side only; see Note 17.	See notes	2 hrs		1		1, 2, 5, 13, 19, 20, 21	2

TABLE 1.1.4—continued
MASONRY WALLS
8″ TO LESS THAN 10″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-8-M-42	$8^{5}/_{8}$″	Core: clay or shale structural tile; facings: side 1; see Note 17.	See notes	2 hrs 30 min		1		1, 2, 6, 9, 18, 20, 21	$2^{1}/_{2}$
W-8-M-43	$8^{5}/_{8}$″	Core: clay or shale structural tile; facings: exposed side only; see Note 17.	See notes	1 hr 30 min		1		1, 2, 6, 9, 19, 20, 21	$1^{1}/_{2}$
W-8-M-44	$8^{5}/_{8}$″	Core: clay or shale structural tile; facings: side 1, see Note 17; side 2, none.	See notes	3 hrs		1		1, 2, 6, 10, 18, 20, 21	3
W-8-M-45	$8^{5}/_{8}$″	Core: clay or shale structural tile; facings: fire side only; see Note 17.	See notes	1 hr 30 min		1		1, 2, 6, 10, 19, 20, 21	$1^{1}/_{2}$
W-8-M-46	$8^{5}/_{8}$″	Core: clay or shale structural tile; facings: side 1, see Note 17; side 2, none.	See notes	3 hrs 30 min		1		1, 2, 6, 12, 18, 20, 21	$3^{1}/_{2}$
W-8-M-47	$8^{5}/_{8}$″	Core: clay or shale structural tile; facings: exposed side only; see Note 17.	See notes	1 hr 45 min		1		1, 2, 6, 12, 19, 20, 21	$1^{3}/_{4}$
W-8-M-48	$8^{5}/_{8}$″	Core: clay or shale structural tile; facings: side 1, see Note 17; side 2, none.	See notes	4 hrs		1		1, 2, 6, 16, 18, 20, 21	4
W-8-M-49	$8^{5}/_{8}$″	Core: clay or shale structural tile; facings: fire side only; see Note 17.	See notes	2 hrs		1		1, 2, 6, 16, 19, 20, 21	2
W-8-M-50	$8^{5}/_{8}$″	Core: 4″, 40% solid clay or shale clay structural tile; 4″ brick plus $^{5}/_{8}$″ of 1:3 sanded gypsum plaster facings on one side.	See notes	4 hrs		1		1, 20	4
W-8-M-51	$8^{3}/_{4}$″	$8^{3}/_{4}$″ × $2^{1}/_{2}$″ and 4″ × $2^{1}/_{2}$″ cellular fletton (1873 psi) single and triple cell hollow brick set in $^{1}/_{2}$″ sand mortar in alternate courses.	3.6 tons/ft	6 hrs			7	23, 29	6
W-8-M-52	$8^{3}/_{4}$″	$8^{3}/_{4}$″ thick cement brick (2527 psi) with Portland cement and sand mortar.	3.6 tons/ft	6 hrs			7	23, 24	6
W-8-M-53	$8^{3}/_{4}$″	$8^{3}/_{4}$″ × $2^{1}/_{2}$″ fletton brick (1831 psi) in $^{1}/_{2}$″ sand mortar.	3.6 tons/ft	6 hrs			7	23, 24	6
W-8-M-54	$8^{3}/_{4}$″	$8^{3}/_{4}$″ × $2^{1}/_{2}$″ London stock brick (683 psi) in $^{1}/_{2}$″ Portland cement and sand mortar.	7.2 tons/ft	6 hrs			7	23, 24	6
W-9-M-55	9″	9″ × $2^{1}/_{2}$″ Leicester red wire-cut brick (4465 psi) in $^{1}/_{2}$″ Portland cement and sand mortar.	6.0 tons/ft	6 hrs			7	23, 24	6
W-9-M-56	9″	9″ × 3″ sand-lime brick (2603 psi) in $^{1}/_{2}$″ Portland cement and sand mortar.	3.6 tons/ft	6 hrs			7	23, 24	6
W-9-M-57	9″	2 layers $2^{7}/_{8}$″ fletton brick (1910 psi) with $3^{1}/_{4}$″ air space; cement and sand mortar.	1.5 tons/ft	32 min			7	23, 25	$^{1}/_{3}$
W-9-M-58	9″	9″ × 3″ stairfoot brick (7527 psi) in $^{1}/_{2}$″ sand-cement mortar.	7.2 tons/ft	6 hrs			7	23, 24	6
W-9-M-59	9″	Core: solid clay or shale brick; $^{1}/_{2}$″ thick; 1:3 sanded gypsum plaster facings on both sides.	See notes	7 hrs		1		1, 22, 45	7
W-9-M-60	9″	Core: concrete brick; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	See notes	8 hrs		1		1, 45	8
W-9-M-61	9″	Core: hollow rolok of clay or shale; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	See notes	4 hrs		1		1, 45	4
W-9-M-62	9″	Cored clay or shale brick; units in wall thickness: 1; cells in wall thickness: 1; minimum % solids: 70; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on one side.	See notes	3 hrs		1		1, 44	3
W-9-M-63	9″	Cored clay or shale brick; units in wall thickness: 2; cells in wall thickness: 2; minimum % solids: 87; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	See notes	7 hrs		1		1, 45	7
W-9-M-64	9-10″	Core: cavity wall of clay or shale brick; no facings.	See notes	5 hrs		1		1, 45	5
W-9-M-65	9-10″	Core: cavity construction of clay or shale brick; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on one side.	See notes	6 hrs		1		1, 45	6
W-9-M-66	9-10″	Core: cavity construction of clay or shale brick; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	See notes	7 hrs		1		1, 45	7

TABLE 1.1.4—continued
MASONRY WALLS
8″ TO LESS THAN 10″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-9-M-67	9 1/4″	Core: clay or shale structural tile; units in wall thickness: 1; cells in wall thickness: 2; minimum % solids in units: 40; 5/8″ of 1:3 sanded gypsum plaster facings on both sides.	See notes	3 hrs		1		1, 20, 21	3
W-9-M-68	9 1/4″	Core: clay or shale structural tile; units in wall thickness: 1; cells in wall thickness: 2; minimum % solids in units: 43; 5/8″ of 1:3 sanded gypsum plaster facings on both sides.	See notes	3 hrs		1		1, 20, 21	3
W-9-M-69	9 1/4″	Core: clay or shale structural tile; facings: sides 1 and 2; see Note 17.	See notes	3 hrs		1		1, 2, 5, 10, 18, 20, 21	3
W-9-M-70	9 1/4″	Core: clay or shale structural tile; facings: sides 1 and 2; see Note 17.	See notes	4 hrs		1		1, 2, 5, 13, 18, 20, 21	4
W-9-M-71	9 1/4″	Core: clay or shale structural tile; facings: sides 1 and 2; see Note 17.	See notes	3 hrs 30 min		1		1, 2, 6, 9, 18, 20, 21	3 1/2
W-9-M-72	9 1/4″	Core: clay or shale structural tile; facings: sides 1 and 2; see Note 17.	See notes	4 hrs		1		1, 2, 6, 10, 18, 20, 21	4
W-9-M-73	9 1/4″	Core: clay or shale structural tile; facings: sides 1 and 2; see Note 17.	See notes	4 hrs		1		1, 2, 6, 12, 18, 20, 21	4
W-9-M-74	9 1/4″	Core: clay or shale structural tile; facings: sides 1 and 2; see Note 17.	See notes	5 hrs		1		1, 2, 6 16, 18, 20, 21	5
W-8-M-75	8″	Cored concrete masonry; see Notes 2, 19, 26, 34, 40; no facings.	80 psi	1 hr 30 min		1		1, 20	1 1/2
W-8-M-76	8″	Cored concrete masonry; see Notes 2, 18, 26, 34, 40; no facings.	80 psi	4 hrs		1		1, 20	4
W-8-M-77	8″	Cored concrete masonry; see Notes 2, 19, 26, 31, 40; no facings.	80 psi	1 hr 15 min		1		1, 20	1 1/4
W-8-M-78	8″	Cored concrete masonry; see Notes 2, 18, 26, 31, 40; no facings.	80 psi	3 hrs		1		1, 20	3
W-8-M-79	8″	Cored concrete masonry; see Notes 2, 19, 26, 36, 41; no facings.	80 psi	1 hr 30 min		1		1, 20	1 1/2
W-8-M-80	8″	Cored concrete masonry; see Notes 2, 18, 26, 36, 41; no facings.	80 psi	3 hrs		1		1, 20	3
W-8-M-81	8″	Cored concrete masonry; see Notes 2, 19, 26, 34, 41; no facings.	80 psi	1 hr		1		1, 20	1
W-8-M-82	8″	Cored concrete masonry; see Notes 2, 18, 26, 34, 41; no facings.	80 psi	2 hrs 30 min		1		1, 20	2 1/2
W-8-M-83	8″	Cored concrete masonry; see Notes 2, 19, 26, 29, 41; no facings.	80 psi	45 min		1		1, 20	3/4
W-8-M-84	8″	Cored concrete masonry; see Notes 2, 18, 26, 29, 41; no facings.	80 psi	2 hrs		1		1, 20	2
W-8-M-85	8″	Cored concrete masonry; see Notes 3, 18, 26, 34, 41; facings: 2 1/4″ brick.	80 psi	4 hrs		1		1, 20	4
W-8-M-86	8″	Cored concrete masonry; see Notes 3, 18, 26, 34, 41; facings: 3 3/4″ brick face.	80 psi	5 hrs		1		1, 20	5
W-8-M-87	8″	Cored concrete masonry; see Notes 2, 19, 26, 30, 43; no facings.	80 psi	12 min		1		1, 20	1/5
W-8-M-88	8″	Cored concrete masonry; see Notes 2, 18, 26, 30, 43; no facings.	80 psi	12 min		1		1, 20	1/5
W-8-M-89	8 1/2″	Cored concrete masonry; see Notes 2, 19, 26, 34, 40; facings: fire side only; see Note 38.	80 psi	2 hrs		1		1, 20	2
W-8-M-90	8 1/2″	Cored concrete masonry; see Notes 2, 18, 26, 34, 40; facings: side 1; see Note 38.	80 psi	5 hrs		1		1, 20	5
W-8-M-91	8 1/2″	Cored concrete masonry; see Notes 2, 19, 26, 31, 40; facings: fire side only; see Note 38.	80 psi	1 hr 45 min		1		1, 20	1 3/4
W-8-M-92	8 1/2″	Cored concrete masonry; see Notes 2, 18, 26, 31, 40; facings: one side; see Note 38.	80 psi	4 hrs		1		1, 20	4

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TABLE 1.1.4—continued
MASONRY WALLS
8″ TO LESS THAN 10″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-8-M-93	$8^1/_2$″	Cored concrete masonry; see Notes 2, 19, 26, 36, 41; facings: fire side only; see Note 38.	80 psi	2 hrs		1		1, 20	2
W-8-M-94	$8^1/_2$″	Cored concrete masonry; see Notes 2, 18, 26, 36, 41; facings: fire side only; see Note 38.	80 psi	4 hrs		1		1, 20	4
W-8-M-95	$8^1/_2$″	Cored concrete masonry; see Notes 2, 19, 26, 34, 41; facings: fire side only; see Note 38.	80 psi	1 hr 30 min		1		1, 20	$1^1/_2$
W-8-M-96	$8^1/_2$″	Cored concrete masonry; see Notes 2, 18, 26, 34, 41; facings: one side; see Note 38.	80 psi	3 hrs				1, 20	3
W-8-M-97	$8^1/_2$″	Cored concrete masonry; see Notes 2, 19, 26, 29, 41; facings: fire side only; see Note 38.	80 psi	1 hr 30 min		1		1, 20	$1^1/_2$
W-8-M-98	$8^1/_2$″	Cored concrete masonry; see Notes 2, 18, 26, 29, 41; facings: one side; see Note 38.	80 psi	2 hrs 30 min		1		1, 20	$2^1/_2$
W-8-M-99	$8^1/_2$″	Cored concrete masonry; see Notes 3, 19, 23, 27, 41; no facings.	80 psi	1 hr 15 min		1		1, 20	$1^1/_4$
W-8-M-100	$8^1/_2$″	Cored concrete masonry; see Notes 3, 18, 23, 27, 41; no facings.	80 psi	3 hrs 30 min		1		1, 20	$3^1/_2$
W-8-M-101	$8^1/_2$″	Cored concrete masonry; see Notes 3, 18, 26, 34, 41; facings: $3^3/_4$″ brick face; one side only; see Note 38.	80 psi	6 hrs		1		1, 20	6
W-8-M-102	$8^1/_2$″	Cored concrete masonry; see Notes 2, 19, 26, 30, 43; facings: fire side only; see Note 38.	80 psi	30 min		1		1, 20	$^1/_2$
W-8-M-103	$8^1/_2$″	Cored concrete masonry; see Notes 2, 18, 26, 30, 43; facings: one side only; see Note 38.	80 psi	12 min		1		1, 20	$^1/_5$
W-9-M-104	9″	Cored concrete masonry; see Notes 2, 18, 26, 34, 40; facings: both sides; see Note 38.	80 psi	6 hrs		1		1, 20	6
W-9-M-105	9″	Cored concrete masonry; see Notes 2, 18, 26, 31, 40; facings: both sides; see Note 38.	80 psi	5 hrs		1		1, 20	5
W-9-M-106	9″	Cored concrete masonry; see Notes 2, 18, 26, 36, 41; facings: both sides of wall; see Note 38.	80 psi	5 hrs		1		1, 20	5
W-9-M-107	9″	Cored concrete masonry; see Notes 2, 18, 26, 34, 41; facings: both sides; see Note 38.	80 psi	4 hrs		1		1, 20	4
W-9-M-108	9″	Cored concrete masonry; see Notes 2, 18, 26, 29, 41; facings: both sides; see Note 38.	80 psi	3 hrs 30 min		1		1, 20	$3^1/_2$
W-9-M-109	9″	Cored concrete masonry; see Notes 3, 19, 23, 27, 40; facings: fire side only; see Note 38.	80 psi	1 hr 45 min		1		1, 20	$1^3/_4$
W-9-M-110	9″	Cored concrete masonry; see Notes 3, 18, 23, 27, 41; facings: one side only; see Note 38.	80 psi	4 hrs		1		1, 20	4
W-9-M-111	9″	Cored concrete masonry; see Notes 3, 18, 26, 34, 41; $2^1/_4$″ brick face on one side only; see Note 38.	80 psi	5 hrs		1		1, 20	5
W-9-M-112	9″	Cored concrete masonry; see Notes 2, 18, 26, 30, 43; facings: both sides; see Note 38.	80 psi	30 min		1		1, 20	$^1/_2$
W-9-M-113	$9^1/_2$″	Cored concrete masonry; see Notes 3, 18, 23, 27, 41; facings: both sides; see Note 38.	80 psi	5 hrs		1		1, 20	5

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

1. Tested at NBS under ASA Spec. No. 43-1934 (ASTM C19-53).
2. One unit in wall thickness.
3. Two units in wall thickness.
4. Two or three units in wall thickness.
5. Two cells in wall thickness.

TABLE 1.1.4—continued
MASONRY WALLS
8″ TO LESS THAN 10″ THICK

6. Three or four cells in wall thickness.
7. Four or five cells in wall thickness.
8. Five or six cells in wall thickness.
9. Minimum percent of solid materials in units = 40%.
10. Minimum percent of solid materials in units = 43%.
11. Minimum percent of solid materials in units = 46%.
12. Minimum percent of solid materials in units = 48%.
13. Minimum percent of solid materials in units = 49%.
14. Minimum percent of solid materials in units = 45%.
15. Minimum percent of solid materials in units = 51%.
16. Minimum percent of solid materials in units = 53%.
17. Not less than $^{5}/_{8}$ inch thickness of 1:3 sanded gypsum plaster.
18. Noncombustible or no members framed into wall.
19. Combustible members framed into wall.
20. Load: 80 psi for gross cross-sectional area of wall.
21. Portland cement-lime mortar.
22. Failure mode—thermal.
23. British test.
24. Passed all criteria.
25. Failed by sudden collapse with no preceding signs of impending failure.
26. One cell in wall thickness.
27. Two cells in wall thickness.
28. Three cells in wall thickness.
29. Minimum percent of solid material in concrete units = 52.
30. Minimum percent of solid material in concrete units = 54.
31. Minimum percent of solid material in concrete units = 55.
32. Minimum percent of solid material in concrete units = 57.
33. Minimum percent of solid material in concrete units = 60.
34. Minimum percent of solid material in concrete units = 62.
35. Minimum percent of solid material in concrete units = 65.
36. Minimum percent of solid material in concrete units = 70.
37. Minimum percent of solid material in concrete units = 76.
38. Not less than $^{1}/_{2}$ inch of 1:3 sanded gypsum plaster.
39. Three units in wall thickness.
40. Concrete units made with expanded slag or pumice aggregates.
41. Concrete units made with expanded burned clay or shale, crushed limestone, air-cooled slag or cinders.
42. Concrete units made with calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.
43. Concrete units made with siliceous sand and gravel. Ninety percent or more quartz, chert and dolomite.
44. Load: 120 psi for gross cross-sectional area of wall.
45. Load: 160 psi for gross cross-sectional area of wall.

FIGURE 1.1.5
MASONRY WALLS
10″ TO LESS THAN 12″ THICK

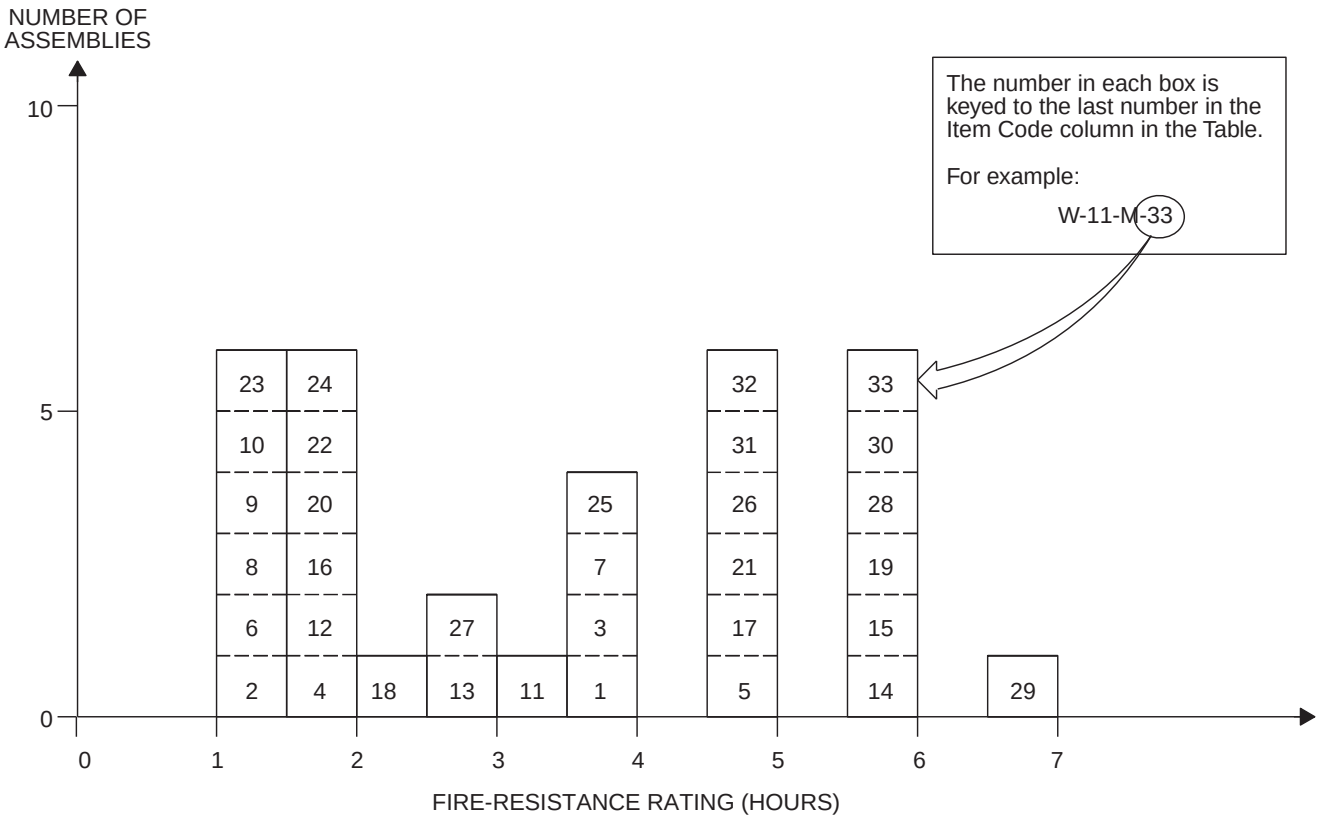

TABLE 1.1.5
MASONRY WALLS
10″ TO LESS THAN 12″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-10-M-1	10″	Core: two $3^{3}/_{4}$″, 40% solid clay or shale structural tiles with 2″ air space between; facings: $^{3}/_{4}$″ Portland cement plaster on stucco on both sides.	80 psi	4 hrs		1		1, 20	4
W-10-M-2	10″	Core: cored concrete masonry, 2″ air cavity; see Notes 3, 19, 27, 34, 40; no facings.	80 psi	1 hr 30 min		1		1, 20	$1^{1}/_{2}$
W-10-M-3	10″	Cored concrete masonry; see Notes 3, 18, 27, 34, 40; no facings.	80 psi	4 hrs		1		1, 20	4
W-10-M-4	10″	Cored concrete masonry; see Notes 2, 19, 26, 33, 40; no facings.	80 psi	2 hrs		1		1, 20	2
W-10-M-5	10″	Cored concrete masonry; see Notes 2, 18, 26, 33, 40; no facings.	80 psi	5 hrs		1		1, 20	5
W-10-M-6	10″	Cored concrete masonry; see Notes 2, 19, 26, 33, 41; no facings.	80 psi	1 hr 30 min		1		1, 20	$1^{1}/_{2}$
W-10-M-7	10″	Cored concrete masonry; see Notes 2, 18, 26, 33, 41; no facings.	80 psi	4 hrs		1		1, 20	4
W-10-M-8	10″	Cored concrete masonry (cavity type 2″ air space); see Notes 3, 19, 27, 34, 42; no facings.	80 psi	1 hr 15 min		1		1, 20	$1^{1}/_{4}$

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TABLE 1.1.5—continued
MASONRY WALLS
10″ TO LESS THAN 12″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-10-M-9	10″	Cored concrete masonry (cavity type 2″ air space); see Notes 3, 18, 27, 34, 42; no facings.	80 psi	1 hr 15 min		1		1, 20	$1^1/_4$
W-10-M-10	10″	Cored concrete masonry (cavity type 2″ air space); see Notes 3, 19, 27, 34, 41; no facings.	80 psi	1 hr 15 min		1		1, 20	$1^1/_4$
W-10-M-11	10″	Cored concrete masonry (cavity type 2″ air space); see Notes 3, 18, 27, 34, 41; no facings.	80 psi	3 hrs 30 min		1		1, 20	$3^1/_2$
W-10-M-12	10″	9″ thick concrete block ($11^3/_4$″ × 9″ × $4^1/_4$″) with two 2″ thick voids included; $^3/_8$″ P.C. plaster $^1/_8$″ neat gypsum.	N/A	1 hr 53 min			7	23, 44	$1^3/_4$
W-10-M-13	10″	Holly clay tile block wall—$8^1/_2$″ block with two 3″ voids in each $8^1/_2$″ section; $^3/_4$″ gypsum plaster each face.	N/A	2 hrs 42 min			7	23, 25	$2^1/_2$
W-10-M-14	10″	Two layers $4^1/_4$″ thick Fletton brick (1910 psi) with $1^1/_2$″ air space; no ties; sand cement mortar.	N/A	6 hrs			7	23, 24	6
W-10-M-15	10″	Two layers $4^1/_4$″ thick Fletton brick (1910 psi); $1^1/_2$″ air space; ties: 18″ o.c. vertical; 3′ o.c. horizontal.	N/A	6 hrs			7	23, 24	6
W-10-M-16	$10^1/_2$″	Cored concrete masonry; 2″ air cavity; see Notes 3, 19, 27, 34, 40; facings: fire side only; see Note 38.	80 psi	2 hrs		1		1, 20	2
W-10-M-17	$10^1/_2$″	Cored concrete masonry; see Notes 3, 18, 27, 34, 40; facings: side 1 only; see Note 38.	80 psi	5 hrs		1		1, 20	5
W-10-M-18	$10^1/_2$″	Cored concrete masonry; see Notes 2, 19, 26, 33, 40; facings: fire side only; see Note 38.	80 psi	2 hrs 30 min		1		1, 20	$2^1/_2$
W-10-M-19	$10^1/_2$″	Cored concrete masonry; see Notes 2, 18, 26, 33, 40; facings: one side; see Note 38.	80 psi	6 hrs		1		1, 20	6
W-10-M-20	$10^1/_2$″	Cored concrete masonry; see Notes 2, 19, 26, 33, 41; facings: fire side of wall only; see Note 38.	80 psi	2 hrs		1		1, 20	2
W-10-M-21	$10^1/_2$″	Cored concrete masonry; see Notes 2, 18, 26, 33, 41; facings: one side only; see Note 38.	80 psi	5 hrs		1		1, 20	5
W-10-M-22	$10^1/_2$″	Cored concrete masonry (cavity type 2″ air space); see Notes 3, 19, 27, 34, 42; facings: fire side only; see Note 38.	80 psi	1 hr 45 min		1		1, 20	$1^3/_4$
W-10-M-23	$10^1/_2$″	Cored concrete masonry (cavity type 2″ air space); see Notes 3, 18, 27, 34, 42; facings: one side only; see Note 38.	80 psi	1 hr 15 min		1		1, 20	$1^1/_4$
W-10-M-24	$10^1/_2$″	Cored concrete masonry (cavity type 2″ air space); see Notes 3, 19, 27, 34, 41; facings: fire side only; see Note 38.	80 psi	2 hrs		1		1, 20	2
W-10-M-25	$10^1/_2$″	Cored concrete masonry (cavity type 2″ air space); see Notes 3, 18, 27, 34, 41; facings: one side only; see Note 38.	80 psi	4 hrs		1		1, 20	4
W-10-M-26	$10^5/_8$″	Core: 8″, 40% solid tile plus 2″ furring tile; $^5/_8$″ sanded gypsum plaster between tile types; facings: both sides $^3/_4$″ Portland cement plaster or stucco.	80 psi	5 hrs		1		1, 20	5
W-10-M-27	$10^5/_8$″	Core: 8″, 40% solid tile plus 2″ furring tile; $^5/_8$″ sanded gypsum plaster between tile types; facings: one side $^3/_4$″ Portland cement plaster or stucco.	80 psi	3 hrs 30 min		1		1, 20	$3^1/_2$
W-11-M-28	11″	Cored concrete masonry; see Notes 3, 18, 27, 34, 40; facings: both sides; see Note 38.	80 psi	6 hrs		1		1, 20	6
W-11-M-29	11″	Cored concrete masonry; see Notes 2, 18, 26, 33, 40; facings: both sides; see Note 38.	80 psi	7 hrs		1		1, 20	7
W-11-M-30	11″	Cored concrete masonry; see Notes 2, 18, 26, 33, 41; facings: both sides of wall; see Note 38.	80 psi	6 hrs		1		1, 20	6
W-11-M-31	11″	Cored concrete masonry (cavity type 2″ air space); see Notes 3, 18, 27, 34, 42; facings: both sides; see Note 38.	80 psi	5 hrs		1		1, 20	5
W-11-M-32	11″	Cored concrete masonry (cavity type 2″ air space); see Notes 3, 18, 27, 34, 41; facings: both sides; see Note 38.	80 psi	5 hrs		1		1, 20	5
W-11-M-33	11″	Two layers brick ($4^1/_2$″ Fletton, 2428 psi) 2″ air space; galvanized ties 18″ o.c. horizontal, 3′ o.c. vertical.	3 tons/ ft	6 hrs			7	23, 24	6

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TABLE 1.1.5—continued
MASONRY WALLS
10″ TO LESS THAN 12″ THICK

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

1. Tested at NBS under ASA Spec. No. A2-1934.
2. One unit in wall thickness.
3. Two units in wall thickness.
4. Two or three units in wall thickness.
5. Two cells in wall thickness.
6. Three or four cells in wall thickness.
7. Four or five cells in wall thickness.
8. Five or six cells in wall thickness.
9. Minimum percent of solid materials in units = 40%.
10. Minimum percent of solid materials in units = 43%.
11. Minimum percent of solid materials in units = 46%.
12. Minimum percent of solid materials in units = 48%.
13. Minimum percent of solid materials in units = 49%.
14. Minimum percent of solid materials in units = 45%.
15. Minimum percent of solid materials in units = 51%.
16. Minimum percent of solid materials in units = 53%.
17. Not less than $^{5}/_{8}$ inch thickness of 1:3 sanded gypsum plaster.
18. Noncombustible or no members framed into wall.
19. Combustible members framed into wall.
20. Load: 80 psi for gross cross-sectional area of wall.
21. Portland cement-lime mortar.
22. Failure mode—thermal.
23. British test.
24. Passed all criteria.
25. Failed by sudden collapse with no preceding signs of impending failure.
26. One cell in wall thickness.
27. Two cells in wall thickness.
28. Three cells in wall thickness.
29. Minimum percent of solid material in concrete units = 52%.
30. Minimum percent of solid material in concrete units = 54%.
31. Minimum percent of solid material in concrete units = 55%.
32. Minimum percent of solid material in concrete units = 57%.
33. Minimum percent of solid material in concrete units = 60%.
34. Minimum percent of solid material in concrete units = 62%.
35. Minimum percent of solid material in concrete units = 65%.
36. Minimum percent of solid material in concrete units = 70%.
37. Minimum percent of solid material in concrete units = 76%.
38. Not less than $^{1}/_{2}$ inch of 1:3 sanded gypsum plaster.
39. Three units in wall thickness.
40. Concrete units made with expanded slag or pumice aggregates.
41. Concrete units made with expanded burned clay or shale, crushed limestone, air-cooled slag or cinders.
42. Concrete units made with calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.

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FIGURE 1.1.6
MASONRY WALLS
12″ TO LESS THAN 14″ THICK

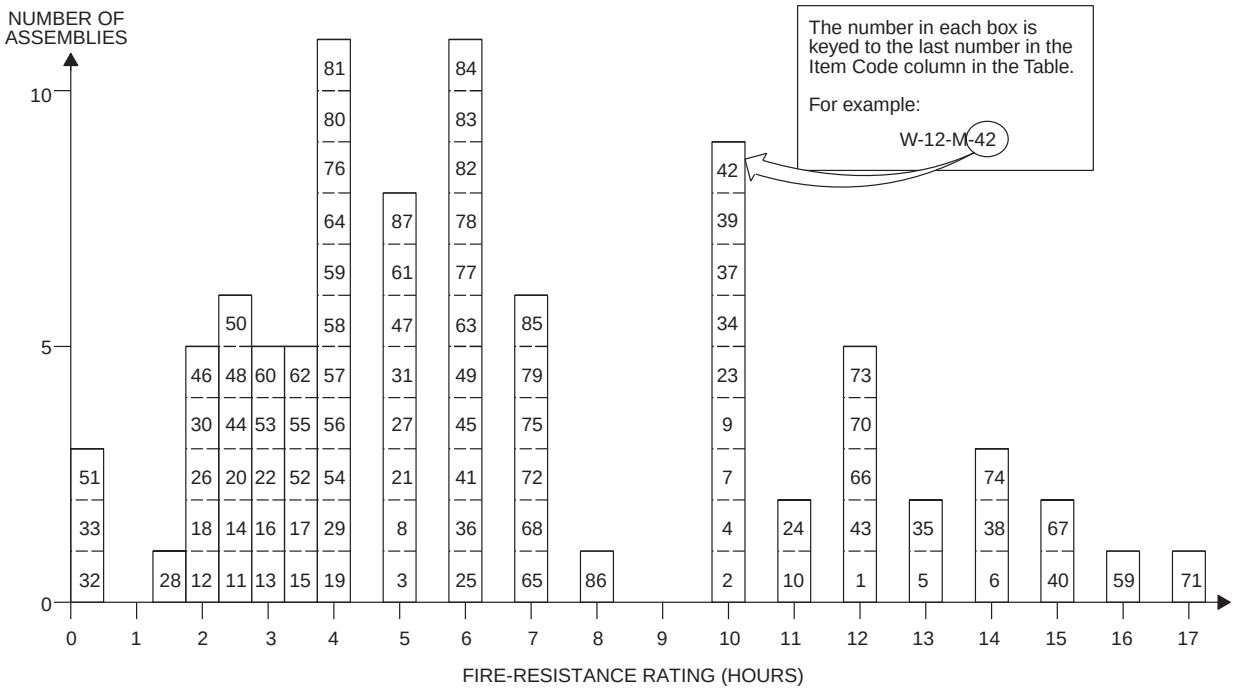
NUMBER OF ASSEMBLIES
10
5
0
The number in each box is keyed to the last number in the Item Code column in the Table.
For example:
W-12-M-42
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
FIRE-RESISTANCE RATING (HOURS)

TABLE 1.1.6
MASONRY WALLS
12″ TO LESS THAN 14″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-12-M-1	12″	Core: solid clay or shale brick; no facings.	N/A	12 hrs		1		1	12
W-12-M-2	12″	Core: solid clay or shale brick; no facings.	160 psi	10 hrs		1		1, 44	10
W-12-M-3	12″	Core: hollow rolok of clay or shale; no facings.	160 psi	5 hrs		1		1, 44	5
W-12-M-4	12″	Core: hollow rolok bak of clay or shale; no facings.	160 psi	10 hrs		1		1, 44	10
W-12-M-5	12″	Core: concrete brick; no facings.	160 psi	13 hrs		1		1, 44	13
W-12-M-6	12″	Core: sand-lime brick; no facings.	N/A	14 hrs		1		1	14
W-12-M-7	12″	Core: sand-lime brick; no facings.	160 psi	10 hrs		1		1, 44	10
W-12-M-8	12″	Cored clay or shale brick; units in wall thickness: 1; cells in wall thickness: 2; minimum % solids: 70; no facings.	120 psi	5 hrs		1		1, 45	5
W-12-M-9	12″	Cored clay or shale brick; units in wall thickness: 3; cells in wall thickness: 3; minimum % solids: 87; no facings.	160 psi	10 hrs		1		1, 44	10
W-12-M-10	12″	Cored clay or shale brick; units in wall thickness: 3; cells in wall thickness: 3; minimum % solids: 87; no facings.	N/A	11 hrs		1		1	11
W-12-M-11	12″	Core: clay or shale structural tile; see Notes 2, 6, 9, 18; no facings.	80 psi	2 hrs 30 min		1		1, 20	$2^1/_2$
W-12-M-12	12″	Core: clay or shale structural tile; see Notes 2, 4, 9, 19; no facings.	80 psi	2 hrs		1		1, 20	2
W-12-M-13	12″	Core: clay or shale structural tile; see Notes 2, 6, 14, 19; no facings.	80 psi	3 hrs		1		1, 20	3

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TABLE 1.1.6—continued
MASONRY WALLS
12″ TO LESS THAN 14″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-12-M-14	12″	Core: clay or shale structural tile; see Notes 2, 6, 14, 18; no facings.	80 psi	2 hrs 30 min		1		1, 20	$2^1/_2$
W-12-M-15	12″	Core: clay or shale structural tile; see Notes 2, 4, 13, 18; no facings.	80 psi	3 hrs 30 min		1		1, 20	$3^1/_2$
W-12-M-16	12″	Core: clay or shale structural tile; see Notes 2, 4, 13, 19; no facings.	80 psi	3 hrs		1		1, 20	3
W-12-M-17	12″	Core: clay or shale structural tile; see Notes 3, 6, 9, 18; no facings.	80 psi	3 hrs 30 min		1		1, 20	$3^1/_2$
W-12-M-18	12″	Core: clay or shale structural tile; see Notes 3, 6, 9, 19; no facings.	80 psi	2 hrs		1		1, 20	2
W-12-M-19	12″	Core: clay or shale structural tile; see Notes 3, 6, 14, 18; no facings.	80 psi	4 hrs		1		1, 20	4
W-12-M-20	12″	Core: clay or shale structural tile; see Notes 3, 6, 14, 19; no facings.	80 psi	2 hrs 30 min		1		1, 20	$2^1/_2$
W-12-M-21	12″	Core: clay or shale structural tile; see Notes 3, 6, 16, 18; no facings.	80 psi	5 hrs		1		1, 20	5
W-12-M-22	12″	Core: clay or shale structural tile; see Notes 3, 6, 16, 19; no facings.	80 psi	3 hrs		1		1, 20	3
W-12-M-23	12″	Core: 8″, 70% solid clay or shale structural tile; 4″ brick facings on one side.	80 psi	10 hrs		1		1, 20	10
W-12-M-24	12″	Core: 8″, 70% solid clay or shale structural tile; 4″ brick facings on one side.	N/A	11 hrs		1		1	11
W-12-M-25	12″	Core: 8″, 40% solid clay or shale structural tile; 4″ brick facings on one side.	80 psi	6 hrs		1		1, 20	6
W-12-M-26	12″	Cored concrete masonry; see Notes 1, 9, 15, 16, 20; no facings.	80 psi	2 hrs		1		1, 20	2
W-12-M-27	12″	Cored concrete masonry; see Notes 2, 18, 26, 34, 41; no facings.	80 psi	5 hrs		1		1, 20	5
W-12-M-28	12″	Cored concrete masonry; see Notes 2, 19, 26, 31, 41; no facings.	80 psi	1 hr 30 min		1		1, 20	$1^1/_2$
W-12-M-29	12″	Cored concrete masonry; see Notes 2, 18, 26, 31, 41; no facings.	80 psi	4 hrs		1		1, 20	4
W-12-M-30	12″	Cored concrete masonry; see Notes 3, 19, 27, 31, 43; no facings.	80 psi	2 hrs		1		1, 20	2
W-12-M-31	12″	Cored concrete masonry; see Notes 3, 18, 27, 31, 43; no facings.	80 psi	5 hrs		1		1, 20	5
W-12-M-32	12″	Cored concrete masonry; see Notes 2, 19, 26, 32, 43; no facings.	80 psi	25 min		1		1, 20	$^1/_3$
W-12-M-33	12″	Cored concrete masonry; see Notes 2, 18, 26, 32, 43; no facings.	80 psi	25 min		1		1, 20	$^1/_3$
W-12-M-34	$12^1/_2$″	Core: solid clay or shale brick; $^1/_2$″ of 1:3 sanded gypsum plaster facings on one side.	160 psi	10 hrs		1		1, 44	10
W-12-M-35	$12^1/_2$″	Core: solid clay or shale brick; $^1/_2$″ of 1:3 sanded gypsum plaster facings on one side.	N/A	13 hrs		1		1	13
W-12-M-36	$12^1/_2$″	Core: hollow rolok of clay or shale; $^1/_2$″ of 1:3 sanded gypsum plaster facings on one side.	160 psi	6 hrs		1		1, 44	6
W-12-M-37	$12^1/_2$″	Core: hollow rolok bak of clay or shale; $^1/_2$″ of 1:3 sanded gypsum plaster facings on one side.	160 psi	10 hrs		1		1, 44	10
W-12-M-38	$12^1/_2$″	Core: concrete; $^1/_2$″ of 1:3 sanded gypsum plaster facings on one side.	160 psi	14 hrs		1		1, 44	14
W-12-M-39	$12^1/_2$″	Core: sand-lime brick; $^1/_2$″ of 1:3 sanded gypsum plaster facings on one side.	160 psi	10 hrs		1		1, 44	10

TABLE 1.1.6—continued
MASONRY WALLS
12″ TO LESS THAN 14″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-12-M-40	12 1/2″	Core: sand-lime brick; 1/2″ of 1:3 sanded gypsum plaster facings on one side.	N/A	15 hrs		1		1	15
W-12-M-41	12 1/2″	Cored clay or shale brick; units in wall thickness: 1; cells in wall thickness: 2; minimum % solids: 70; 1/2″ of 1:3 sanded gypsum plaster facings on one side.	120 psi	6 hrs		1		1, 45	6
W-12-M-42	12 1/2″	Cored clay or shale brick; units in wall thickness: 3; cells in wall thickness: 3; minimum % solids: 87; 1/2″ of 1:3 sanded gypsum plaster facings on one side.	160 psi	10 hrs		1		1, 44	10
W-12-M-43	12 1/2″	Cored clay or shale brick; units in wall thickness: 3; cells in wall thickness: 3; minimum % solids: 87; 1/2″ of 1:3 sanded gypsum plaster facings on one side.	N/A	12 hrs		1		1	12
W-12-M-44	12 1/2″	Cored concrete masonry; see Notes 2, 19, 26, 34, 41; facings: fire side only; see Note 38.	80 psi	2 hrs 30 min		1		1, 20	2 1/2
W-12-M-45	12 1/2″	Cored concrete masonry; see Notes 2, 18, 26, 34, 39, 41; facings: one side only; see Note 38.	80 psi	6 hrs		1		1, 20	6
W-12-M-46	12 1/2″	Cored concrete masonry; see Notes 2, 19, 26, 31, 41; facings: fire side only; see Note 38.	80 psi	2 hrs		1		1, 20	2
W-12-M-47	12 1/2″	Cored concrete masonry; see Notes 2, 18, 26, 31, 41; facings: one side of wall only; see Note 38.	80 psi	5 hrs		1		1, 20	5
W-12-M-48	12 1/2″	Cored concrete masonry; see Notes 3, 19, 27, 31, 43; facings: fire side only; see Note 38.	80 psi	2 hrs 30 min		1		1, 20	2 1/2
W-12-M-49	12 1/2″	Cored concrete masonry; see Notes 3, 18, 27, 31, 43; facings: one side only; see Note 38.	80 psi	6 hrs		1		1, 20	6
W-12-M-50	12 1/2″	Cored concrete masonry; see Notes 2, 19, 26, 32, 43; facings: fire side only; see Note 38.	80 psi	2 hrs 30 min		1		1, 20	2 1/2
W-12-M-51	12 1/2″	Cored concrete masonry; see Notes 2, 18, 26, 32, 43; facings: one side only; see Note 38.	80 psi	25 min		1		1, 20	1/3
W-12-M-52	12 5/8″	Clay or shale structural tile; see Notes 2, 6, 9, 18; facings: side 1, see Note 17; side 2, none.	80 psi	3 hrs 30 min		1		1, 20	3 1/2
W-12-M-53	12 5/8″	Clay or shale structural tile; see Notes 2, 6, 9, 19; facings: fire side only; see Note 17.	80 psi	3 hrs		1		1, 20	3
W-12-M-54	12 5/8″	Clay or shale structural tile; see Notes 2, 6, 14, 19; facings: side 1, see Note 17; side 2, none.	80 psi	4 hrs		1		1, 20	4
W-12-M-55	12 5/8″	Clay or shale structural tile; see Notes 2, 6, 14, 18; facings: exposed side only; see Note 17.	80 psi	3 hrs 30 min		1		1, 20	3 1/2
W-12-M-56	12 5/8″	Clay or shale structural tile; see Notes 2, 4, 13, 18; facings: side 1, see Note 17; side 2, none.	80 psi	4 hrs		1		1, 20	4
W-12-M-57	12 5/8″	Clay or shale structural tile; see Notes 1, 4, 13, 19; facings: fire side only; see Note 17.	80 psi	4 hrs		1		1, 20	4
W-12-M-58	12 5/8″	Clay or shale structural tile; see Notes 3, 6, 9, 18; facings: side 1, see Note 17; side 2, none.	80 psi	4 hrs		1		1, 20	4
W-12-M-59	12 5/8″	Clay or shale structural tile; see Notes 3, 6, 9, 19; facings: fire side only; see Note 17.	80 psi	3 hrs		1		1, 20	3

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TABLE 1.1.6—continued
MASONRY WALLS
12″ TO LESS THAN 14″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-12-M-60	$12^{5}/_{8}$″	Clay or shale structural tile; see Notes 3, 6, 14, 18; facings: side 1, see Note 17; side 2, none.	80 psi	5 hrs		1		1, 20	5
W-12-M-61	$12^{5}/_{8}$″	Clay or shale structural tile; see Notes 3, 6, 14, 19; facings: fire side only; see Note 17.	80 psi	3 hrs 30 min		1		1, 20	$3^{1}/_{2}$
W-12-M-62	$12^{5}/_{8}$″	Clay or shale structural tile; see Notes 3, 6, 16, 18; facings: side 1, see Note 17; side 2, none.	80 psi	6 hrs		1		1, 20	6
W-12-M-63	$12^{5}/_{8}$″	Clay or shale structural tile; see Notes 3, 6, 16, 19; facings: fire side only; see Note 17.	80 psi	4 hrs		1		1, 20	4
W-12-M-64	$12^{5}/_{8}$″	Core: 8″, 40% solid clay or shale structural tile; facings: 4″ brick plus $^{5}/_{8}$″ of 1:3 sanded gypsum plaster on one side.	80 psi	7 hrs		1		1, 20	7
W-13-M-65	13″	Core: solid clay or shale brick; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	160 psi	12 hrs		1		1, 44	12
W-13-M-66	13″	Core: solid clay or shale brick; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	N/A	15 hrs		1		1, 20	15
W-13-M-67	13″	Core: solid clay or shale brick; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	N/A	15 hrs		1		1	15
W-13-M-68	13″	Core: hollow rolok of clay or shale; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	80 psi	7 hrs		1		1, 20	7
W-13-M-69	13″	Core: concrete brick; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	160 psi	16 hrs		1		1, 44	16
W-13-M-70	13″	Core: sand-lime brick; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	160 psi	12 hrs		1		1, 44	12
W-13-M-71	13″	Core: sand-lime brick; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	N/A	17 hrs		1		1	17
W-13-M-72	13″	Cored clay or shale brick; units in wall thickness: 1; cells in wall thickness: 2; minimum % solids: 70; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	120 psi	7 hrs		1		1, 45	7
W-13-M-73	13″	Cored clay or shale brick; units in wall thickness: 3; cells in wall thickness: 3; minimum % solids: 87; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	160 psi	12 hrs		1		1, 44	12
W-13-M-74	13″	Cored clay or shale brick; units in wall thickness: 3; cells in wall thickness: 2; minimum % solids: 87; $^{1}/_{2}$″ of 1:3 sanded gypsum plaster facings on both sides.	N/A	14 hrs		1		1	14
W-13-M-75	13″	Cored concrete masonry; see Notes 18, 23, 28, 39, 41; no facings.	80 psi	7 hrs		1		1, 20	7
W-13-M-76	13″	Cored concrete masonry; see Notes 19, 23, 28, 39, 41; no facings.	80 psi	4 hrs		1		1, 20	4
W-13-M-77	13″	Cored concrete masonry; see Notes 3, 18, 27, 31, 43; facings: both sides; see Note 38.	80 psi	6 hrs		1		1, 20	6
W-13-M-78	13″	Cored concrete masonry; see Notes 2, 18, 26, 31, 41; facings: both sides; see Note 38.	80 psi	6 hrs		1		1, 20	6
W-13-M-79	13″	Cored concrete masonry; see Notes 2, 18, 26, 34, 41; facings: both sides of wall; see Note 38.	80 psi	7 hrs		1		1, 20	7
W-13-M-80	$13^{1}/_{4}$″	Core: clay or shale structural tile; see Notes 2, 6, 9, 18; facings: both sides; see Note 17.	80 psi	4 hrs		1		1, 20	4

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TABLE 1.1.6—continued
MASONRY WALLS
12″ TO LESS THAN 14″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-13-M-81	$13^1/_4$″	Core: clay or shale structural tile; see Notes 2, 6, 14, 19; facings: both sides; see Note 17.	80 psi	4 hrs		1		1, 20	4
W-13-M-82	$13^1/_4$″	Core: clay or shale structural tile; see Notes 2, 4, 13, 18; facings: both sides; see Note 17.	80 psi	6 hrs		1		1, 20	6
W-13-M-83	$13^1/_4$″	Core: clay or shale structural tile; see Notes 3, 6, 9, 18; facings: both sides; see Note 17.	80 psi	6 hrs		1		1, 20	6
W-13-M-84	$13^1/_4$″	Core: clay or shale structural tile; see Notes 3, 6, 14, 18; facings: both sides; see Note 17.	80 psi	6 hrs		1		1, 20	6
W-13-M-85	$13^1/_4$″	Core: clay or shale structural tile; see Notes 3, 6, 16, 18; facings: both sides; see Note 17.	80 psi	7 hrs		1		1, 20	7
W-13-M-86	$13^1/_2$″	Cored concrete masonry; see Notes 18, 23, 28, 39, 41; facings: one side only; see Note 38.	80 psi	8 hrs		1		1, 20	8
W-13-M-87	$13^1/_2$″	Cored concrete masonry; see Notes 19, 23, 28, 39, 41; facings: fire side only; see Note 38.	80 psi	5 hrs		1		1, 20	5

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

1. Tested at NBS under ASA Spec. No. A2-1934.
2. One unit in wall thickness.
3. Two units in wall thickness.
4. Two or three units in wall thickness.
5. Two cells in wall thickness.
6. Three or four cells in wall thickness.
7. Four or five cells in wall thickness.
8. Five or six cells in wall thickness.
9. Minimum percent of solid materials in units = 40%.
10. Minimum percent of solid materials in units = 43%.
11. Minimum percent of solid materials in units = 46%.
12. Minimum percent of solid materials in units = 48%.
13. Minimum percent of solid materials in units = 49%.
14. Minimum percent of solid materials in units = 45%.
15. Minimum percent of solid materials in units = 51%.
16. Minimum percent of solid materials in units = 53%.
17. Not less than $^5/_8$ inch thickness of 1:3 sanded gypsum plaster.
18. Noncombustible or no members framed into wall.
19. Combustible members framed into wall.
20. Load: 80 psi for gross area.
21. Portland cement-lime mortar.
22. Failure mode–thermal.
23. British test.
24. Passed all criteria.
25. Failed by sudden collapse with no preceding signs of impending failure.
26. One cell in wall thickness.
27. Two cells in wall thickness.
28. Three cells in wall thickness.
29. Minimum percent of solid material in concrete units = 52%.
30. Minimum percent of solid material in concrete units = 54%.
31. Minimum percent of solid material in concrete units = 55%.
32. Minimum percent of solid material in concrete units = 57%.
33. Minimum percent of solid material in concrete units = 60%.
34. Minimum percent of solid material in concrete units = 62%.
35. Minimum percent of solid material in concrete units = 65%.
36. Minimum percent of solid material in concrete units = 70%.
37. Minimum percent of solid material in concrete units = 76%.
38. Not less than $^1/_2$ inch of 1:3 sanded gypsum plaster.
39. Three units in wall thickness.
40. Concrete units made with expanded slag or pumice aggregates.
41. Concrete units made with expanded burned clay or shale, crushed limestone, air-cooled slag or cinders.

TABLE 1.1.6—continued
MASONRY WALLS
12″ TO LESS THAN 14″ THICK

42. Concrete units made with calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.
43. Concrete units made with siliceous sand and gravel. Ninety percent or more quartz, chert or flint.
44. Load: 160 psi of gross wall cross-sectional area.
45. Load: 120 psi of gross wall cross-sectional area.

FIGURE 1.1.7
MASONRY WALLS
14″ OR MORE THICK

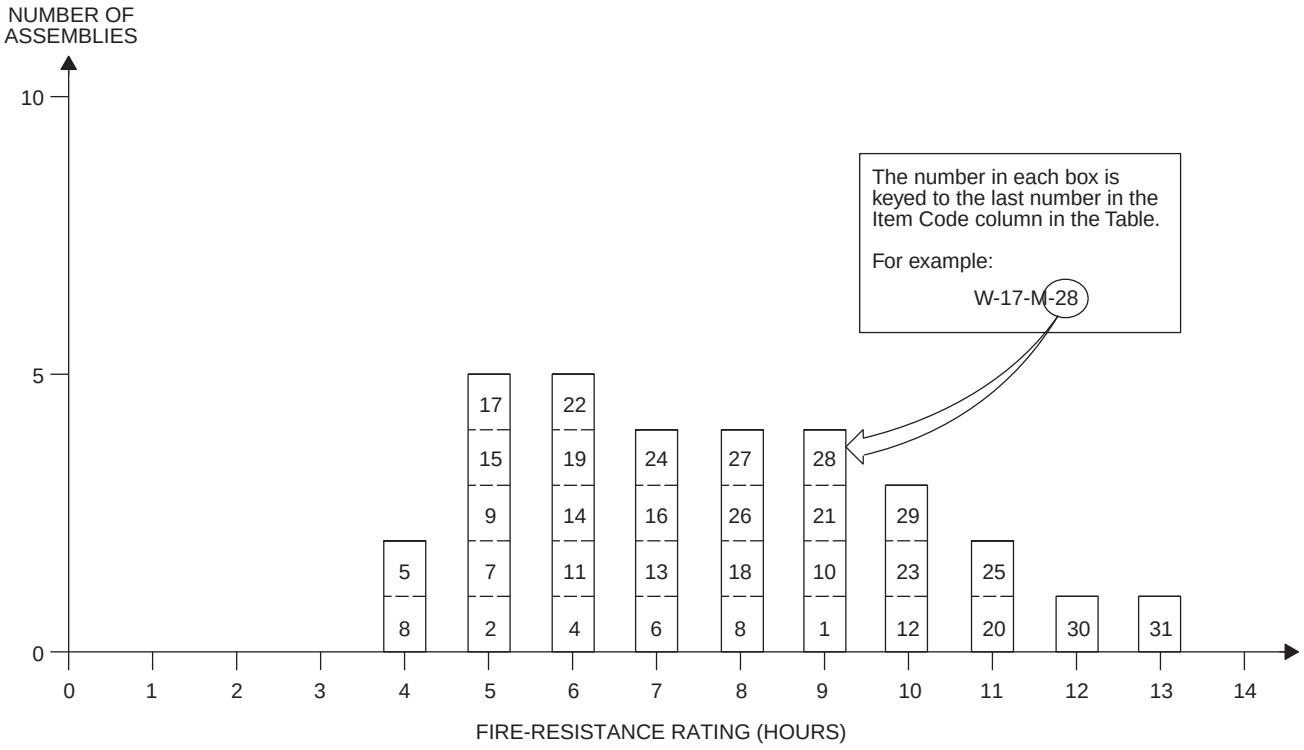
NUMBER OF ASSEMBLIES
10
5
0
The number in each box is keyed to the last number in the Item Code column in the Table.
For example:
W-17-M-28
5 8
17 15 9 7 2
22 19 14 11 4
24 16 13 6
27 26 18 8
28 21 10 1
29 23 12
25 20
30
31
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
FIRE-RESISTANCE RATING (HOURS)

TABLE 1.1.7
MASONRY WALLS
14″ OR MORE THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-14-M-1	14″	Core: cored masonry; see Notes 18, 28, 35, 39, 41; facings: both sides; see Note 38.	80 psi	9 hrs		1		1, 20	9
W-16-M-2	16″	Core: clay or shale structural tile; see Notes 4, 7, 9, 19; no facings.	80 psi	5 hrs		1		1, 20	5
W-16-M-3	16″	Core: clay or shale structural tile; see Notes 4, 7, 9, 19; no facings.	80 psi	4 hrs		1		1, 20	4
W-16-M-4	16″	Core: clay or shale structural tile; see Notes 4, 7, 10, 18; no facings.	80 psi	6 hrs		1		1, 20	6
W-16-M-5	16″	Core: clay or shale structural tile; see Notes 4, 7, 10, 19; no facings.	80 psi	4 hrs		1		1, 20	4
W-16-M-6	16″	Core: clay or shale structural tile; see Notes 4, 7, 11, 18; no facings.	80 psi	7 hrs		1		1, 20	7
W-16-M-7	16″	Core: clay or shale structural tile; see Notes 4, 7, 11, 19; no facings.	80 psi	5 hrs		1		1, 20	5
W-16-M-8	16″	Core: clay or shale structural tile; see Notes 4, 8, 13, 18; no facings.	80 psi	8 hrs		1		1, 20	8
W-16-M-9	16″	Core: clay or shale structural tile; see Notes 4, 8, 13, 19; no facings.	80 psi	5 hrs		1		1, 20	5

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TABLE 1.1.7—continued
MASONRY WALLS
14″ OR MORE THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-16-M-10	16″	Core: clay or shale structural tile; see Notes 4, 8, 15, 18; no facings.	80 psi	9 hrs		1		1, 20	9
W-16-M-11	16″	Core: clay or shale structural tile; see Notes 3, 7, 14, 18; no facings.	80 psi	6 hrs		1		1, 20	6
W-16-M-12	16″	Core: clay or shale structural tile; see Notes 4, 8, 16, 18; no facings.	80 psi	10 hrs		1		1, 20	10
W-16-M-13	16″	Core: clay or shale structural tile; see Notes 4, 6, 16, 19; no facings.	80 psi	7 hrs		1		1, 20	7
W-16-M-14	$16^{5}/_{8}$″	Core: clay or shale structural tile; see Notes 4, 7, 9, 18; facings: side 1, see Note 17; side 2, none.	80 psi	6 hrs		1		1, 20	6
W-16-M-15	$16^{5}/_{8}$″	Core: clay or shale structural tile; see Notes 4, 7, 9, 19; facings: fire side only; see Note 17.	80 psi	5 hrs		1		1, 20	5
W-16-M-16	$16^{5}/_{8}$″	Core: clay or shale structural tile; see Notes 4, 7, 10, 18; facings: side 1, see Note 17; side 2, none.	80 psi	7 hrs		1		1, 20	7
W-16-M-17	$16^{5}/_{8}$″	Core: clay or shale structural tile; see Notes 4, 7, 10, 19; facings: fire side only; see Note 17.	80 psi	5 hrs		1		1, 20	5
W-16-M-18	$16^{5}/_{8}$″	Core: clay or shale structural tile; see Notes 4, 7, 11, 18; facings: side 1, see Note 17; side 2, none.	80 psi	8 hrs		1		1, 20	8
W-16-M-19	$16^{5}/_{8}$″	Core: clay or shale structural tile; see Notes 4, 7, 11, 19; facings: fire side only; see Note 17.	80 psi	6 hrs		1		1, 20	6
W-16-M-20	$16^{5}/_{8}$″	Core: clay or shale structural tile; see Notes 4, 8, 13, 18; facings: sides 1 and 2, see Note 17.	80 psi	11 hrs		1		1, 20	11
W-16-M-21	$16^{5}/_{8}$″	Core: clay or shale structural tile; see Notes 4, 8, 13 18; facings: side 1, see Note 17; side 2, none.	80 psi	9 hrs		1		1, 20	9
W-16-M-22	$16^{5}/_{8}$″	Core: clay or shale structural tile; see Notes 4, 8, 13, 19; facings: fire side only; see Note 17.	80 psi	6 hrs		1		1, 20	6
W-16-M-23	$16^{5}/_{8}$″	Core: clay or shale structural tile; see Notes 4, 8, 15, 18; facings: side 1, see Note 17; side 2, none.	80 psi	10 hrs		1		1, 20	10
W-16-M-24	$16^{5}/_{8}$″	Core: clay or shale structural tile; see Notes 4, 8, 15, 19; facings: fire side only; see Note 17.	80 psi	7 hrs		1		1, 20	7
W-16-M-25	$16^{5}/_{8}$″	Core: clay or shale structural tile; see Notes 4, 6, 16, 18; facings: side 1, see Note 17; side 2, none.	80 psi	11 hrs		1		1, 20	11
W-16-M-26	$16^{5}/_{8}$″	Core: clay or shale structural tile; see Notes 4, 6, 16, 19; facings: fire side only; see Note 17.	80 psi	8 hrs		1		1, 20	8
W-17-M-27	$17^{1}/_{4}$″	Core: clay or shale structural tile; see Notes 4, 7, 9, 18; facings: sides 1 and 2, see Note 17.	80 psi	8 hrs		1		1, 20	8
W-17-M-28	$17^{1}/_{4}$″	Core: clay or shale structural tile; see Notes 4, 7, 10, 18; facings: sides 1 and 2, see Note 17.	80 psi	9 hrs		1		1, 20	9
W-17-M-29	$17^{1}/_{4}$″	Core: clay or shale structural tile; see Notes 4, 7, 11, 18; facings: sides 1 and 2, see Note 17.	80 psi	10 hrs		1		1, 20	10
W-17-M-30	$17^{1}/_{4}$″	Core: clay or shale structural tile; see Notes 4, 8, 15, 18; facings: sides 1 and 2, see Note 17.	80 psi	12 hrs		1		1, 20	12

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TABLE 1.1.7—continued
MASONRY WALLS
14″ OR MORE THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-17-M-31	$17^{1}/_{4}$″	Core: clay or shale structural tile; see Notes 4, 6, 16, 18; facings: sides 1 and 2, see Note 17.	80 psi	13 hrs		1		1, 20	13

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

1. Tested at NBS under ASA Spec. No. A2-1934.
2. One unit in wall thickness.
3. Two units in wall thickness.
4. Two or three units in wall thickness.
5. Two cells in wall thickness.
6. Three or four cells in wall thickness.
7. Four or five cells in wall thickness.
8. Five or six cells in wall thickness.
9. Minimum percent of solid materials in units = 40%.
10. Minimum percent of solid materials in units = 43%.
11. Minimum percent of solid materials in units = 46%.
12. Minimum percent of solid materials in units = 48%.
13. Minimum percent of solid materials in units = 49%.
14. Minimum percent of solid materials in units = 45%.
15. Minimum percent of solid materials in units = 51%.
16. Minimum percent of solid materials in units = 53%.
17. Not less than $^{5}/_{8}$ inch thickness of 1:3 sanded gypsum plaster.
18. Noncombustible or no members framed into wall.
19. Combustible members framed into wall.
20. Load: 80 psi for gross area.
21. Portland cement-lime mortar.
22. Failure mode—thermal.
23. British test.
24. Passed all criteria.
25. Failed by sudden collapse with no preceding signs of impending failure.
26. One cell in wall thickness.
27. Two cells in wall thickness.
28. Three cells in wall thickness.
29. Minimum percent of solid material in concrete units = 52%.
30. Minimum percent of solid material in concrete units = 54%.
31. Minimum percent of solid material in concrete units = 55%.
32. Minimum percent of solid material in concrete units = 57%.
33. Minimum percent of solid material in concrete units = 60%.
34. Minimum percent of solid material in concrete units = 62%.
35. Minimum percent of solid material in concrete units = 65%.
36. Minimum percent of solid material in concrete units = 70%.
37. Minimum percent of solid material in concrete units = 76%.
38. Not less than $^{1}/_{2}$ inch of 1:3 sanded gypsum plaster.
39. Three units in wall thickness.
40. Concrete units made with expanded slag or pumice aggregates.
41. Concrete units made with expanded burned clay or shale, crushed limestone, air-cooled slag or cinders.
42. Concrete units made with calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.
43. Concrete units made with siliceous sand and gravel. Ninety percent or more quartz, chert or flint.

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FIGURE 1.2.1
METAL FRAME WALLS
0″ TO LESS THAN 4″ THICK

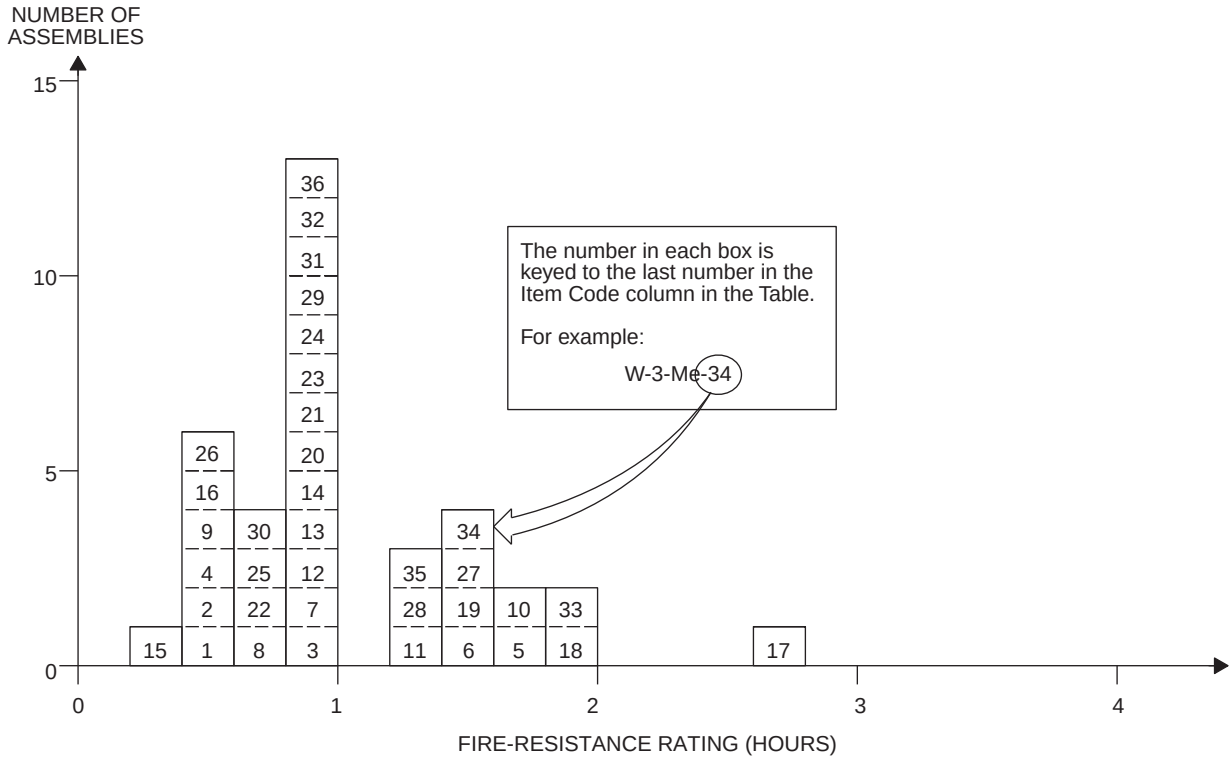

TABLE 1.2.1
METAL FRAME WALLS
0″ TO LESS THAN 4″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-3-Me-1	3″	Core: steel channels having three rows of 4″ × $^1/_8$″ staggered slots in web; core filled with heat expanded vermiculite weighing 1.5 lbs/ft^2 of wall area; facings: sides 1 and 2, 18 gage steel, spot welded to core.	N/A	25 min		1			$^1/_3$
W-3-Me-2	3″	Core: steel channels having three rows of 4″ × $^1/_8$″ staggered slots in web; core filled with heat expanded vermiculite weighing 2 lbs/ft^2 of wall area; facings: sides 1 and 2, 18 gage steel, spot welded to core.	N/A	30 min		1			$^1/_2$
W-2-Me-3	2$^1/_2$″	Solid partition: $^3/_8$″ tension rods (vertical) 3′ o.c. with metal lath; scratch coat: cement/sand/lime plaster; float coats: cement/sand/lime plaster; finish coats: neat gypsum plaster.	N/A	1 hr			7	1	1
W-2-Me-4	2″	Solid wall: steel channel per Note 1; 2″ thickness of 1:2; 1:3 Portland cement on metal lath.	N/A	30 min		1			$^1/_2$
W-2-Me-5	2″	Solid wall: steel channel per Note 1; 2″ thickness of neat gypsum plaster on metal lath.	N/A	1 hr 45 min		1			1$^3/_4$
W-2-Me-6	2″	Solid wall: steel channel per Note 1; 2″ thickness of 1:$^1/_2$; 1:$^1/_2$ gypsum plaster on metal lath.	N/A	1 hr 30 min		1			1$^1/_2$

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TABLE 1.2.1—continued
METAL FRAME WALLS
0″ TO LESS THAN 4″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-2-Me-7	2″	Solid wall: steel channel per Note 2; 2″ thickness of 1:1; 1:1 gypsum plaster on metal lath.	N/A	1 hr		1			1
W-2-Me-8	2″	Solid wall: steel channel per Note 1; 2″ thickness of 1:2; 1:2 gypsum plaster on metal lath.	N/A	45 min		1			3/4
W-2-Me-9	2 1/4″	Solid wall: steel channel per Note 2; 2 1/4″ thickness of 1:2; 1:3 Portland cement on metal lath.	N/A	30 min		1			1/2
W-2-Me-10	2 1/4″	Solid wall: steel channel per Note 2; 2 1/4″ thickness of neat gypsum plaster on metal lath.	N/A	2 hrs		1			2
W-2-Me-11	2 1/4″	Solid wall: steel channel per Note 2; 2 1/4″thickness of 1:1/2; 1:1/2 gypsum plaster on metal lath.	N/A	1 hr 45 min		1			1 3/4
W-2-Me-12	2 1/4″	Solid wall: steel channel per Note 2; 2 1/4″ thickness of 1:1; 1:1 gypsum plaster on metal lath.	N/A	1 hr 15 min		1			1 1/4
W-2-Me-13	2 1/4″	Solid wall: steel channel per Note 2; 2 1/4″ thickness of 1:2; 1:2 gypsum plaster on metal lath.	N/A	1 hr		1			1
W-2-Me-14	2 1/2″	Solid wall: steel channel per Note 1; 2 1/2″ thickness of 4.5:1:7; 4.5:1:7 Portland cement, sawdust and sand sprayed on wire mesh; see Note 3 for wire mesh.	N/A	1 hr		1			1
W-2-Me-15	2 1/2″	Solid wall: steel channel per Note 2; 2 1/2″ thickness of 1:4; 1:4 Portland cement sprayed on wire mesh; see Note 3.	N/A	20 min		1			1/3
W-2-Me-16	2 1/2″	Solid wall: steel channel per Note 2; 2 1/2″ thickness of 1:2; 1:3 Portland cement on metal lath.	N/A	30 min		1			1/2
W-2-Me-17	2 1/2″	Solid wall: steel channel per Note 2; 2 1/2″ thickness of neat gypsum plaster on metal lath.	N/A	2 hrs 30 min		1			2 1/2
W-2-Me-18	2 1/2″	Solid wall: steel channel per Note 2; 2 1/2″ thickness of 1:1/2; 1:1/2 gypsum plaster on metal lath.	N/A	2 hrs		1			2
W-2-Me-19	2 1/2″	Solid wall: steel channel per Note 2; 2 1/2″ thickness of 1:1; 1:1 gypsum plaster on metal lath.	N/A	1 hr 30 min		1			1 1/2
W-2-Me-20	2 1/2″	Solid wall: steel channel per Note 2; 2 1/2″ thickness of 1:2; 1:2 gypsum plaster on metal lath.	N/A	1 hr		1			1
W-2-Me-21	2 1/2″	Solid wall: steel channel per Note 2; 2 1/2″ thickness of 1:2; 1:3 gypsum plaster on metal lath.	N/A	1 hr		1			1
W-3-Me-22	3″	Core: steel channel per Note 2; 1:2; 1:2 gypsum plaster on 3/4″ soft asbestos lath; plaster thickness 2″.	N/A	45 min		1			3/4
W-3-Me-23	3 1/2″	Solid wall: steel channel per Note 2; 2 1/2″ thickness of 1:2; 1:2 gypsum plaster on 3/4″ asbestos lath.	N/A	1 hr		1			1
W-3-Me-24	3 1/2″	Solid wall: steel channel per Note 2; lath over and 1:2 1/2; 1:2 1/2 gypsum plaster on 1″ magnesium oxysulfate wood fiberboard; plaster thickness 2 1/2″.	N/A	1 hr		1			1
W-3-Me-25	3 1/2″	Core: steel studs; see Note 4; facings: 3/4″ thickness of 1:1/30:2; 1:1/30:3 Portland cement and asbestos fiber plaster.	N/A	45 min		1			3/4

TABLE 1.2.1—continued
METAL FRAME WALLS
0″ TO LESS THAN 4″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-3-Me-26	$3^1/_2$″	Core: steel studs; see Note 4; facings: both sides $^3/_4$″ thickness of 1:2; 1:3 Portland cement.	N/A	30 min		1			$^1/_2$
W-3-Me-27	$3^1/_2$″	Core: steel studs; see Note 4; facings: both sides $^3/_4$″ thickness of neat gypsum plaster.	N/A	1 hr 30 min		1			$1^1/_2$
W-3-Me-28	$3^1/_2$″	Core: steel studs; see Note 4; facings: both sides $^3/_4$″ thickness of 1:$^1/_2$; 1:$^1/_2$ gypsum plaster.	N/A	1 hr 15 min		1			$1^1/_4$
W-3-Me-29	$3^1/_2$″	Core: steel studs; see Note 4; facings: both sides $^3/_4$″ thickness of 1:2; 1:2 gypsum plaster.	N/A	1 hr		1			1
W-3-Me-30	$3^1/_2$″	Core: steel studs; see Note 4; facings: both sides $^3/_4$″ thickness of 1:2; 1:3 gypsum plaster.	N/A	45 min		1			$^3/_4$
W-3-Me-31	$3^3/_4$″	Core: steel studs; see Note 4; facings: both sides $^7/_8$″ thickness of 1:$^1/_{30}$: 2; 1:$^1/_{30}$: 3 Portland cement and asbestos fiber plaster.	N/A	1 hr		1			1
W-3-Me-32	$3^3/_4$″	Core: steel studs; see Note 4; facings: both sides $^7/_8$″ thickness of 1:2; 1:3 Portland cement.	N/A	45 min		1			$^3/_4$
W-3-Me-33	$3^3/_4$″	Core: steel studs; see Note 4; facings: both sides $^7/_8$″ thickness of neat gypsum plaster.	N/A	2 hrs		1			2
W-3-Me-34	$3^3/_4$″	Core: steel studs; see Note 4; facings: both sides $^7/_8$″ thickness of 1:$^1/_2$; 1:$^1/_2$ gypsum plaster.	N/A	1 hr 30 min		1			$1^1/_2$
W-3-Me-35	$3^3/_4$″	Core: steel studs; see Note 4; facings: both sides $^7/_8$″ thickness of 1:2; 1:2 gypsum plaster.	N/A	1 hr 15 min		1			$1^1/_4$
W-3-Me-36	$3^3/_4$″	Core: steel; see Note 4; facings: $^7/_8$″ thickness of 1:2; 1:3 gypsum plaster on both sides.	N/A	1 hr		1			1

For SI: 1 inch = 25.4 mm.

Notes:

1. Failure mode—local temperature rise—back face.
2. Three-fourths inch or 1 inch channel framing—hot-rolled or strip-steel channels.
3. Reinforcement is 4-inch square mesh of No. 6 wire welded at intersections (no channels).
4. Ratings are for any usual type of non-load-bearing metal framing providing 2 inches (or more) air space.

General Note:

The construction details of the wall assemblies are as complete as the source documentation will permit. Data on the method of attachment of facings and the gage of steel studs was provided when known. The cross-sectional area of the steel stud can be computed, thereby permitting a reasoned estimate of actual loading conditions. For load-bearing assemblies, the maximum allowable stress for the steel studs has been provided in the table "Notes." More often, it is the thermal properties of the facing materials, rather than the specific gage of the steel, that will determine the degree of fire resistance. This is particularly true for nonbearing wall assemblies.

FIGURE 1.2.2
METAL FRAME WALLS
4″ TO LESS THAN 6″ THICK

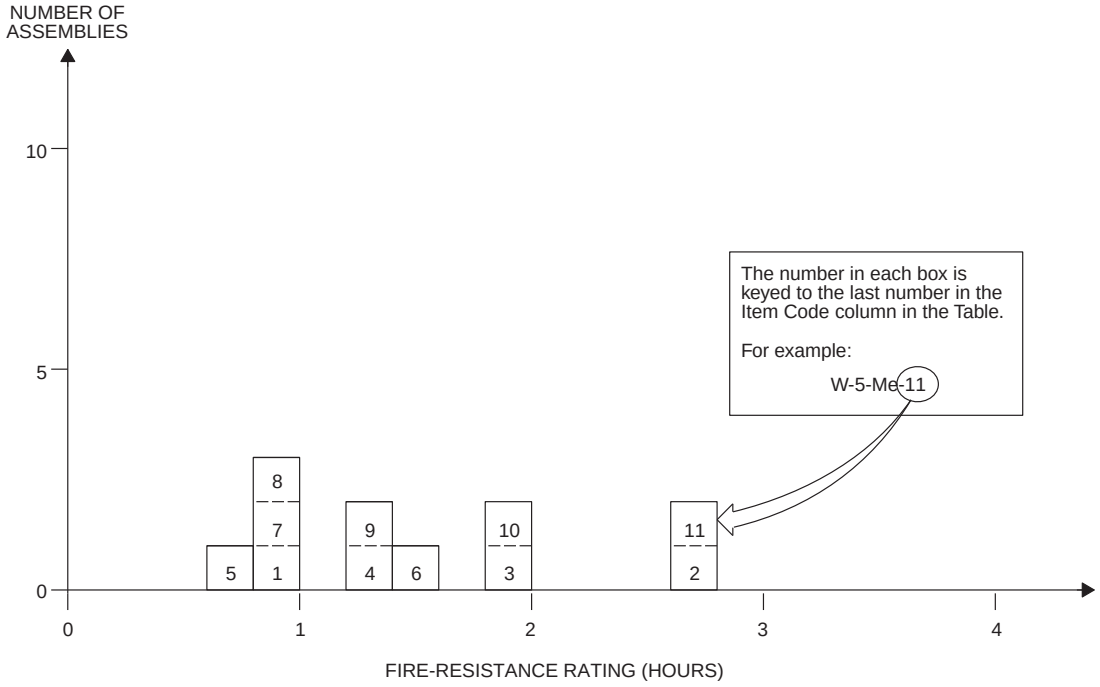

TABLE 1.2.2
METAL FRAME WALLS
4″ TO LESS THAN 6″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-5-Me-1	$5^1/_2$″	3″ cavity with 16 gage channel studs ($3^1/_2$′ o.c.) of $^1/_2$″ × $^1/_2$″ channel and 3″ spacer; metal lath on ribs with plaster (three coats) $^3/_4$″ over face of lath; plaster (each side): scratch coat, cement/lime/sand with hair; float coat, cement/lime/sand; finish coat, neat gypsum.	N/A	1 hr 11 min			7	1	1
W-4-Me-2	4″	Core: steel studs; see Note 2; facings: both sides 1″ thickness of neat gypsum plaster.	N/A	2 hrs 30 min		1			$2^1/_2$
W-4-Me-3	4″	Core: steel studs; see Note 2; facings: both sides 1″ thickness of 1:$^1/_2$; 1:$^1/_2$ gypsum plaster.	N/A	2 hrs		1			2
W-4-Me-4	4″	Core: steel; see Note 2; facings: both sides 1″ thickness of 1:2; 1:3 gypsum plaster.	N/A	1 hr 15 min		1			$1^1/_4$
W-4-Me-5	$4^1/_2$″	Core: lightweight steel studs 3″ in depth; facings: both sides $^3/_4$″ thick sanded gypsum plaster, 1:2 scratch coat, 1:3 brown coat applied on metal lath.	See Note 4	45 min		1		5	$^3/_4$
W-4-Me-6	$4^1/_2$″	Core: lightweight steel studs 3″ in depth; facings: both sides $^3/_4$″ thick neat gypsum plaster on metal lath.	See Note 4	1 hr 30 min		1		5	$1^1/_2$
W-4-Me-7	$4^1/_2$″	Core: lightweight steel studs 3″ in depth; facings: both sides $^3/_4$″ thick sanded gypsum plaster, 1:2 scratch and brown coats applied on metal lath.	See Note 4	1 hr		1		5	1
W-4-Me-8	$4^3/_4$″	Core: lightweight steel studs 3″ in depth; facings: both sides $^7/_8$″ thick sanded gypsum plaster, 1:2 scratch coat, 1:3 brown coat, applied on metal lath.	See Note 4	1 hr		1		5	1
W-4-Me-9	$4^3/_4$″	Core: lightweight steel studs 3″ in depth; facings: both sides $^7/_8$″ thick sanded gypsum plaster, 1:2 scratch and 1:3 brown coats applied on metal lath.	See Note 4	1 hr 15 min		1		5	$1^1/_4$

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TABLE 1.2.2—continued
METAL FRAME WALLS
4″ TO LESS THAN 6″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-5-Me-10	5″	Core: lightweight steel studs 3″ in depth; facings: both sides 1″ thick neat gypsum plaster on metal lath.	See Note 4	2 hrs		1		5	2
W-5-Me-11	5″	Core: lightweight steel studs 3″ in depth; facings: both sides 1″ thick neat gypsum plaster on metal lath.	See Note 4	2 hrs 30 min		1		5, 6	$2^1/_2$

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

1. Failure mode—local back face temperature rise.
2. Ratings are for any usual type of nonbearing metal framing providing a minimum 2-inch air space.
3. Facing materials secured to lightweight steel studs not less than 3 inches deep.
4. Rating based on loading to develop a maximum stress of 7270 psi for net area of each stud.
5. Spacing of steel studs must be sufficient to develop adequate rigidity in the metal-lath or gypsum-plaster base.
6. As per Note 4 but load/stud not to exceed 5120 psi.

General Note:

The construction details of the wall assemblies are as complete as the source documentation will permit. Data on the method of attachment of facings and the gage of steel studs was provided when known. The cross-sectional area of the steel stud can be computed, thereby permitting a reasoned estimate of actual loading conditions. For load-bearing assemblies, the maximum allowable stress for the steel studs has been provided in the table "Notes." More often, it is the thermal properties of the facing materials, rather than the specific gage of the steel, that will determine the degree of fire resistance. This is particularly true for nonbearing wall assemblies.

TABLE 1.2.3
METAL FRAME WALLS
6″ TO LESS THAN 8″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-6-Me-1	$6^5/_8$″	On one side of 1″ magnesium oxysulfate wood fiberboard sheathing attached to steel studs (see Notes 1 and 2), 1″ air space, $3^3/_4$″ brick secured with metal ties to steel frame every fifth course; inside facing of $^7/_8$″ 1:2 sanded gypsum plaster on metal lath secured directly to studs; plaster side exposed to fire.	See Note 2	1 hr 45 min		1		1	$1^3/_4$
W-6-Me-2	$6^5/_8$″	On one side of 1″ magnesium oxysulfate wood fiberboard sheathing attached to steel studs (see Notes 1 and 2), 1″ air space, $3^3/_4$″ brick secured with metal ties to steel frame every fifth course; inside facing of $^7/_8$″ 1:2 sanded gypsum plaster on metal lath secured directly to studs; brick face exposed to fire.	See Note 2	4 hrs		1		1	4
W-6-Me-3	$6^5/_8$″	On one side of 1″ magnesium oxysulfate wood fiberboard sheathing attached to steel studs (see Notes 1 and 2), 1″ air space, $3^3/_4$″ brick secured with metal ties to steel frame every fifth course; inside facing of $^7/_8$″ vermiculite plaster on metal lath secured directly to studs; plaster side exposed to fire.	See Note 2	2 hrs		1		1	2

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

1. Lightweight steel studs (minimum 3 inches deep) used. Stud spacing dependent on loading, but in each case, spacing is to be such that adequate rigidity is provided to the metal lath plaster base.
2. Load is such that stress developed in studs is not greater than 5120 psi calculated from net stud area.

General Note:

The construction details of the wall assemblies are as complete as the source documentation will permit. Data on the method of attachment of facings and the gage of steel studs was provided when known. The cross-sectional area of the steel stud can be computed, thereby permitting a reasoned estimate of actual loading conditions. For load-bearing assemblies, the maximum allowable stress for the steel studs has been provided in the table "Notes." More often, it is the thermal properties of the facing materials, rather than the specific gage of the steel, that will determine the degree of fire resistance. This is particularly true for nonbearing wall assemblies.

TABLE 1.2.4
METAL FRAME WALLS
8″ TO LESS THAN 10″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-9-Me-1	$9^1/_{16}$″	On one side of $^1/_2$″ wood fiberboard sheathing next to studs, $^3/_4$″ air space formed with $^3/_4$″ × $1^5/_8$″ wood strips placed over the fiberboard and secured to the studs, paper-backed wire lath nailed to strips $3^3/_4$″ brick veneer held in place by filling a $^3/_4$″ space between the brick and paper-backed lath with mortar; inside facing of $^3/_4$″ neat gypsum plaster on metal lath attached to $^5/_{16}$″ plywood strips secured to edges of steel studs; rated as combustible because of the sheathing; see Notes 1 and 2; plaster exposed.	See Note 2	1 hr 30 min		1		1	$1^1/_2$
W-9-Me-2	$9^1/_{16}$″	Same as above with brick exposed.	See Note 2	4 hrs		1		1	4
W-8-Me-3	$8^1/_2$″	On one side of paper-backed wire lath attached to studs and $3^3/_4$″ brick veneer held in place by filling a 1″ space between the brick and lath with mortar; inside facing of 1″ paper-enclosed mineral wool blanket weighing 0.6 lb./ft^2 attached to studs, metal lath or paper-backed wire lath laid over the blanket and attached to the studs, $^3/_4$″ sanded gypsum plaster 1:2 for the scratch coat and 1:3 for the brown coat; see Notes 1 and 2; plaster face exposed.	See Note 2	4 hrs		1		1	4
W-8-Me-4	$8^1/_2$″	Same as above with brick exposed.	See Note 2	5 hrs		1		1	5

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

1. Lightweight steel studs ≥ 3 inches in depth. Stud spacing dependent on loading, but in any case, the spacing is to be such that adequate rigidity is provided to the metal-lath plaster base.
2. Load is such that stress developed in studs is ≤ 5120 psi calculated from the net area of the stud.

General Note:

The construction details of the wall assemblies are as complete as the source documentation will permit. Data on the method of attachment of facings and the gage of steel studs was provided when known. The cross-sectional area of the steel stud can be computed, thereby permitting a reasoned estimate of actual loading conditions. For load-bearing assemblies, the maximum allowable stress for the steel studs has been provided in the table "Notes." More often, it is the thermal properties of the facing materials, rather than the specific gage of the steel, that will determine the degree of fire resistance. This is particularly true for nonbearing wall assemblies.

TABLE 1.3.1
WOOD FRAME WALLS
0″ TO LESS THAN 4″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-3-W-1	$3^3/_4$″	Solid wall: $2^1/_4$″ wood-wool slab core; $^3/_4$″ gypsum plaster each side.	N/A	2 hrs			7	1, 6	2
W-3-W-2	$3^7/_8$″	2 × 4 stud wall; $^3/_{16}$″ thick cement asbestos board on both sides of wall.	360 psi net area	10 min		1		2–5	$^1/_6$
W-3-W-3	$3^7/_8$″	Same as W-3-W-2 but stud cavities filled with 1 lb./ft^2 mineral wool batts.	360 psi net area	40 min		1		2–5	$^2/_3$

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

1. Achieved "Grade C" fire resistance (British).
2. Nominal 2 × 4 wood studs of No. 1 common or better lumber set edgewise, 2 × 4 plates at top and bottom and blocking at mid-height of wall.
3. All horizontal joints in facing material backed by 2 × 4 blocking in wall.
4. Load: 360 psi of net stud cross-sectional area.
5. facings secured with 6d casing nails. Nail holes predrilled and 0.02 inch to 0.03 inch smaller than nail diameter.
6. The wood-wool core is a pressed excelsior slab which possesses insulating properties similar to cellulosic insulation.

FIGURE 1.3.2
WOOD FRAME WALLS
4″ TO LESS THAN 6″ THICK

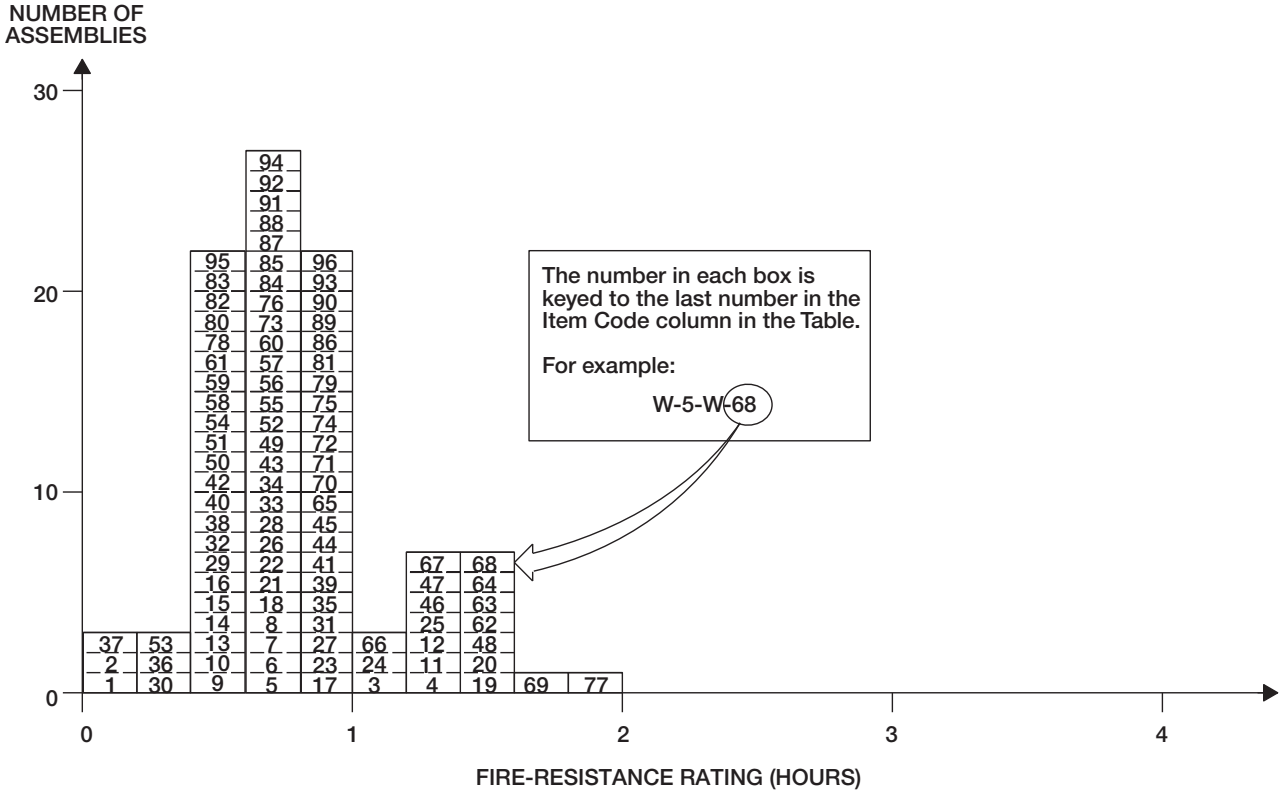

TABLE 1.3.2
WOOD FRAME WALLS
4″ TO LESS THAN 6″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-W-1	4″	2″ × 4″ stud wall; $^{3}/_{16}$″ CAB; no insulation; design A.	35 min	10 min			4	1–10	$^{1}/_{6}$
W-4-W-2	$4^{1}/_{8}$″	2″ × 4″ stud wall; $^{3}/_{16}$″ CAB; no insulation; design A.	38 min	9 min			4	1–10	$^{1}/_{6}$
W-4-W-3	$4^{3}/_{4}$″	2″ × 4″ stud wall; $^{3}/_{16}$″ CAB and $^{3}/_{8}$″ gypsum board face (both sides); design B.	62 min	64 min			4	1–10	1
W-5-W-4	5″	2″ × 4″ stud wall; $^{3}/_{16}$″ CAB and $^{1}/_{2}$″ gypsum board (both sides); design B.	79 min	Greater than 90 min			4	1–10	1
W-4-W-5	$4^{3}/_{4}$″	2″ × 4″ stud wall; $^{3}/_{16}$″ CAB and $^{3}/_{8}$″ gypsum board (both sides); design B.	45 min	45 min			4	1–12	—
W-5-W-6	5″	2″ × 4″ stud wall; $^{3}/_{16}$″ CAB and $^{1}/_{2}$″ gypsum board face (both sides); design B.	45 min	45 min			4	1–10, 12, 13	—
W-4-W-7	4″	2″ × 4″ stud wall; $^{3}/_{16}$″ CAB face; $3^{1}/_{2}$″ mineral wool insulation; design C.	40 min	42 min			4	1–10	$^{2}/_{3}$
W-4-W-8	4″	2″ × 4″ stud wall; $^{3}/_{16}$″ CAB face; $3^{1}/_{2}$″ mineral wool insulation; design C.	46 min	46 min			4	1–10, 43	$^{2}/_{3}$
W-4-W-9	4″	2″ × 4″ stud wall; $^{3}/_{16}$″ CAB face; $3^{1}/_{2}$″ mineral wool insulation; design C.	30 min	30 min			4	1–10, 12, 14	—
W-4-W-10	$4^{1}/_{8}$″	2″ × 4″ stud wall; $^{3}/_{16}$″ CAB face; $3^{1}/_{2}$″ mineral wool insulation; design C.	—	30 min			4	1–8, 12, 14	—

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TABLE 1.3.2—continued
WOOD FRAME WALLS
4″ TO LESS THAN 6″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-W-11	4 3/4″	2″ × 4″ stud wall; 3/16″ CAB face; 3/8″ gypsum strips over studs; 5 1/2″ mineral wool insulation; design D.	79 min	79 min			4	1–10	1
W-4-W-12	4 3/4″	2″ × 4″ stud wall; 3/16″ CAB face; 3/8″ gypsum strips at stud edges; 7 1/2″ mineral wool insulation; design D.	82 min	82 min			4	1–10	1
W-4-W-13	4 3/4″	2″ × 4″ stud wall; 3/16″ CAB face; 3/8″ gypsum board strips over studs; 5 1/2″ mineral wool insulation; design D.	30 min	30 min			4	1–12	—
W-4-W-14	4 3/4″	2″ × 4″ stud wall; 3/16″ CAB face; 3/8″ gypsum board strips over studs; 7″ mineral wool insulation; design D.	30 min	30 min			4	1–12	—
W-5-W-15	5 1/2″	2″ × 4″ stud wall; exposed face: CAB shingles over 1″ × 6″; unexposed face: 1/8″ CAB sheet; 7/16″ fiberboard (wood); design E.	34 min	—			4	1–10	1/2
W-5-W-16	5 1/2″	2″ × 4″ stud wall; exposed face: 1/8″ CAB sheet; 7/16″ fiberboard; unexposed face: CAB shingles over 1″ × 6″; design E.	32 min	33 min			4	1–10	1/2
W-5-W-17	5 1/2″	2″ × 4″ stud wall; exposed face: CAB shingles over 1″ × 6″; unexposed face: 1/8″ CAB sheet; gypsum board at stud edges; 3 1/2″ mineral wood insulation; design F.	51 min	—			4	1–10	3/4
W-5-W-18	5 1/2″	2″ × 4″ stud wall; exposed face: 1/8″ CAB sheet; gypsum board at stud edges; unexposed face: CAB shingles over 1″ × 6″; 3 1/2″ mineral wool insulation; design F.	42 min	—			4	1–10	2/3
W-5-W-19	5 5/8″	2″ × 4″ stud wall; exposed face: CAB shingles over 1″ × 6″; unexposed face: 1/8″ CAB sheet; gypsum board at stud edges; 5 1/2″ mineral wool insulation; design G.	74 min	85 min			4	1–10	1
W-5-W-20	5 5/8″	2″ × 4″ stud wall; exposed face: 1/8″ CAB sheet; gypsum board at 3/16″ stud edges; 7/16″ fiberboard; unexposed face: CAB shingles over 1″ × 6″; 5 1/2″ mineral wool insulation; design G.	79 min	85 min			4	1–10	1 1/4
W-5-W-21	5 5/8″	2″ × 4″ stud wall; exposed face: CAB shingles 1″ × 6″ sheathing; unexposed face: CAB sheet; gypsum board at stud edges; 5 1/2″ mineral wool insulation; design G.	38 min	38 min			4	1–10, 12, 14	—
W-5-W-22	5 5/8″	2″ × 4″ stud wall; exposed face: CAB sheet; gypsum board at stud edges; unexposed face: CAB shingles 1″ × 6″ sheathing; 5 1/2″ mineral wool insulation; design G.	38 min	38 min			4	1–12	—
W-6-W-23	6″	2″ × 4″ stud wall; 16″ o.c.; 1/2″ gypsum board each side; 1/2″ gypsum plaster each side.	N/A	60 min			7	15	1
W-6-W-24	6″	2″ × 4″ stud wall; 16″ o.c.; 1/2″ gypsum board each side; 1/2″ gypsum plaster each side.	N/A	68 min			7	16	1
W-6-W-25	6 7/8″	2″ × 4″ stud wall; 18″ o.c.; 3/4″ gypsum plank each side; 3/16″ gypsum plaster each side.	N/A	80 min			7	15	1 1/3
W-5-W-26	5 1/8″	2″ × 4″ stud wall; 16″ o.c.; 3/8″ gypsum board each side; 3/16″ gypsum plaster each side.	N/A	37 min			7	15	1/2
W-5-W-27	5 3/4″	2″ × 4″ stud wall; 16″ o.c.; 3/8″ gypsum lath each side; 1/2″ gypsum plaster each side.	N/A	52 min			7	15	3/4
W-5-W-28	5″	2″ × 4″ stud wall; 16″ o.c.; 1/2″ gypsum board each side.	N/A	37 min			7	16	1/2

TABLE 1.3.2—continued
WOOD FRAME WALLS
4″ TO LESS THAN 6″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-5-W-29	5″	2″ × 4″ stud wall; 1/2″ fiberboard both sides 14% M.C. with F.R. paint at 35 gm/ft^2.	N/A	28 min			7	15	1/3
W-4-W-30	4 3/4″	2″ × 4″ stud wall; fire side: 1/2″ (wood) fiberboard; back side: 1/4″ CAB; 16″ o.c.	N/A	17 min			7	15, 16	1/4
W-5-W-31	5 1/8″	2″ × 4″ stud wall; 16″ o.c.; 1/2″ fiberboard insulation with 1/32″ asbestos (both sides of each board).	N/A	50 min			7	16	3/4
W-4-W-32	4 1/4″	2″ × 4″ stud wall; 3/8″ thick gypsum wallboard on both faces; insulated cavities.	See Note 23	25 min		1		17, 18, 23	1/3
W-4-W-33	4 1/2″	2″ × 4″ stud wall; 1/2″ thick gypsum wallboard on both faces.	See Note 17	40 min		1		17, 23	1/3
W-4-W-34	4 1/2″	2″ × 4″ stud wall; 1/2″ thick gypsum wallboard on both faces; insulated cavities.	See Note 17	45 min		1		17, 18, 23	3/4
W-4-W-35	4 1/2″	2″ × 4″ stud wall; 1/2″ thick gypsum wallboard on both faces; insulated cavities.	N/A	1 hr		1		17, 18, 24	1
W-4-W-36	4 1/2″	2″ × 4″ stud wall; 1/2″ thick, 1.1 lbs/ft^2 wood fiberboard sheathing on both faces.	See Note 23	15 min		1		17, 23	1/4
W-4-W-37	4 1/2″	2″ × 4″ stud wall; 1/2″ thick, 0.7 lb./ft^2 wood fiberboard sheathing on both faces.	See Note 23	10 min		1		17, 23	1/6
W-4-W-38	4 1/2″	2″ × 4″ stud wall; 1/2″ thick, flameproofed 1.6 lbs/ft^2 wood fiberboard sheathing on both faces.	See Note 23	30 min		1		17, 23	1/2
W-4-W-39	4 1/2″	2″ × 4″ stud wall; 1/2″ thick gypsum wallboard on both faces; insulated cavities.	See Note 23	1 hr		1		17, 18, 23	1
W-4-W-40	4 1/2″	2″ × 4″ stud wall; 1/2″ thick, 1:2; 1:3 gypsum plaster on wood lath on both faces.	See Note 23	30 min		1		17, 21, 23	1/2
W-4-W-41	4 1/2″	2″ × 4″ stud wall; 1/2″ thick, 1:2; 1:3 gypsum plaster on wood lath on both faces; insulated cavities.	See Note 23	1 hr		1		17, 18, 21, 23	1
W-4-W-42	4 1/2″	2″ × 4″ stud wall; 1/2″, 1:5; 1:7.5 lime plaster on wood lath on both wall faces.	See Note 23	30 min		1		17, 21, 23	1/2
W-4-W-43	4 1/2″	2″ × 4″ stud wall; 1/2″ thick 1:5; 1:7.5 lime plaster on wood lath on both faces; insulated cavities.	See Note 23	45 min		1		17, 18, 21, 23	3/4
W-4-W-44	4 5/8″	2″ × 4″ stud wall; 3/16″ thick cement-asbestos over 3/8″ thick gypsum board on both faces.	See Note 23	1 hr		1		23, 25, 26, 27	1
W-4-W-45	4 5/8″	2″ × 4″ stud wall; studs faced with 4″ wide strips of 3/8″ thick gypsum board; 3/16″ thick gypsum cement-asbestos board on both faces; insulated cavities.	See Note 23	1 hr		1		23, 25, 27, 28	1
W-4-W-46	4 5/8″	Same as W-4-W-45 but non-load-bearing.	N/A	1 hr 15 min		1		24, 28	1 1/4
W-4-W-47	4 7/8″	2″ × 4″ stud wall; 3/16″ thick cement-asbestos board over 1/2″ thick gypsum sheathing on both faces.	See Note 23	1 hr 15 min		1		23, 25, 26, 27	1 1/4
W-4-W-48	4 7/8″	Same as W-4-W-47 but non-load-bearing.	N/A	1 hr 30 min		1		24, 27	1 1/2
W-5-W-49	5″	2″ × 4″ stud wall; exterior face: 3/4″ wood sheathing; asbestos felt 14 lbs/100 ft^2 and 5/32″ cement-asbestos shingles; interior face: 4″ wide strips of 3/8″ gypsum board over studs; wall faced with 3/16″ thick cement-asbestos board.	See Note 23	40 min		1		18, 23, 25, 26, 29	2/3

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TABLE 1.3.2—continued
WOOD FRAME WALLS
4″ TO LESS THAN 6″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-5-W-50	5″	2″ × 4″ stud wall; exterior face: as per W-5-W-49; interior face: $^{9}/_{16}$″ composite board consisting of $^{7}/_{16}$″ thick wood fiberboard faced with $^{1}/_{8}$″ thick cement-asbestos board; exterior side exposed to fire.	See Note 23	30 min		1		23, 25, 26, 30	$^{1}/_{2}$
W-5-W-51	5″	Same as W-5-W-50 but interior side exposed to fire.	See Note 23	30 min		1		23, 25, 26	$^{1}/_{2}$
W-5-W-52	5″	Same as W-5-W-49 but exterior side exposed to fire.	See Note 23	45 min		1		18, 23, 25, 26	$^{3}/_{4}$
W-5-W-53	5″	2″ × 4″ stud wall; $^{3}/_{4}$″ thick T&G wood boards on both sides.	See Note 23	20 min		1		17, 23	$^{1}/_{3}$
W-5-W-54	5″	Same as W-5-W-53 but with insulated cavities.	See Note 23	35 min		1		17, 18, 23	$^{1}/_{2}$
W-5-W-55	5″	2″ × 4″ stud wall; $^{3}/_{4}$″ thick T&G wood boards on both sides with 30 lbs/100 ft^2 asbestos; paper, between studs and boards.	See Note 23	45 min		1		17, 23	$^{3}/_{4}$
W-5-W-56	5″	2″ × 4″ stud wall; $^{1}/_{2}$″ thick, 1:2; 1:3 gypsum plaster on metal lath on both sides of wall.	See Note 23	45 min		1		17, 21, 23	$^{3}/_{4}$
W-5-W-57	5″	2″ × 4″ stud wall; $^{3}/_{4}$″ thick 2:1:8; 2:1:12 lime and Keene's cement plaster over metal lath on both sides of wall.	See Note 23	45 min		1		17, 21, 23	$^{1}/_{2}$
W-5-W-58	5″	2″ × 4″ stud wall; $^{3}/_{4}$″ thick 2:1:8; 2:1:10 lime Portland cement plaster over metal lath on both sides of wall.	See Note 23	30 min		1		17, 21, 23	$^{1}/_{2}$
W-5-W-59	5″	2″ × 4″ stud wall; $^{3}/_{4}$″ thick 1:5; 1:7.5 lime plaster on metal lath on both sides of wall.	See Note 23	30 min		1		17, 21, 23	$^{1}/_{2}$
W-5-W-60	5″	2″ × 4″ stud wall; $^{3}/_{4}$″ thick 1:$^{1}/_{30}$:2; 1:$^{1}/_{30}$:3 Portland cement, asbestos fiber plaster on metal lath on both sides of wall.	See Note 23	45 min		1		17, 21, 23	$^{3}/_{4}$
W-5-W-61	5″	2″ × 4″ stud wall; $^{3}/_{4}$″ thick 1:2; 1:3 Portland cement plaster on metal lath on both sides of wall.	See Note 23	30 min		1		17, 21, 23	$^{1}/_{2}$
W-5-W-62	5″	2″ × 4″ stud wall; $^{3}/_{4}$″ thick neat gypsum plaster on metal lath on both sides of wall.	N/A	1 hr 30 min		1		17, 22, 24	$1^{1}/_{2}$
W-5-W-63	5″	2″ × 4″ stud wall; $^{3}/_{4}$″ thick neat gypsum plaster on metal lath on both sides of wall.	See Note 23	1 hr 30 min		1		17, 21, 23	$1^{1}/_{2}$
W-5-W-64	5″	2″ × 4″ stud wall; $^{3}/_{4}$″ thick 1:2; 1:2 gypsum plaster on metal lath on both sides of wall; insulated cavities.	See Note 23	1 hr 30 min		1		17, 18, 21, 23	$1^{1}/_{2}$
W-5-W-65	5″	2″ × 4″ stud wall; same as W-5-W-64 but cavities not insulated.	See Note 23	1 hr		1		17, 21, 23	1
W-5-W-66	5″	2″ × 4″ stud wall; $^{3}/_{4}$″ thick 1:2; 1:3 gypsum plaster on metal lath on both sides of wall; insulated cavities.	See Note 23	1 hr 15 min		1		17, 18, 21, 23	$1^{1}/_{4}$
W-5-W-67	$5^{1}/_{16}$″	Same as W-5-W-49 except cavity insulation of 1.75 lbs/ft^2 mineral wool bats; rating applies when either wall side exposed to fire.	See Note 23	1 hr 15 min		1		23, 25, 26	$1^{1}/_{4}$
W-5-W-68	$5^{1}/_{4}$″	2″ × 4″ stud wall, $^{7}/_{8}$″ thick 1:2; 1:3 gypsum plaster on metal lath on both sides of wall; insulated cavities.	See Note 23	1 hr 30 min		1		17, 18, 21, 23	$1^{1}/_{2}$
W-5-W-69	$5^{1}/_{4}$″	2″ × 4″ stud wall; $^{7}/_{8}$″ thick neat gypsum plaster applied on metal lath on both sides of wall.	N/A	1 hr 45 min		1		17, 22, 24	$1^{3}/_{4}$

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TABLE 1.3.2—continued
WOOD FRAME WALLS
4″ TO LESS THAN 6″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-5-W-70	$5^1/_4$″	2″ × 4″ stud wall; $^1/_2$″ thick neat gypsum plaster on $^3/_8$″ plain gypsum lath on both sides of wall.	See Note 23	1 hr		1		17, 22, 23	1
W-5-W-71	$5^1/_4$″	2″ × 4″ stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster on $^3/_8$″ thick plain gypsum lath with $1^3/_4$″ × $1^3/_4$″ metal lath pads nailed 8″ o.c. vertically and 16″ o.c. horizontally on both sides of wall.	See Note 23	1 hr		1		17, 21, 23	1
W-5-W-72	$5^1/_4$″	2″ × 4″ stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster on $^3/_8$″ perforated gypsum lath, one $^3/_4$″ diameter hole or larger per 16″ square of lath surface, on both sides of wall.	See Note 23	1 hr		1		17, 21, 23	1
W-5-W-73	$5^1/_4$″	2″ × 4″ stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster on $^3/_8$″ gypsum lath (plain, indented or perforated) on both sides of wall.	See Note 23	45 min		1		17, 21, 23	$^3/_4$
W-5-W-74	$5^1/_4$″	2″ × 4″ stud wall; $^7/_8$″ thick of 1:2; 1:3 gypsum plaster over metal lath on both sides of wall.	See Note 23	1 hr		1		17, 21, 23	1
W-5-W-75	$5^1/_4$″	2″ × 4″ stud wall; $^7/_8$″ thick of 1:$^1/_{30}$:2; 1:$^1/_{30}$:3 Portland cement, asbestos plaster applied over metal lath on both sides of wall.	See Note 23	1 hr		1		17, 21, 23	1
W-5-W-76	$5^1/_4$″	2″ × 4″ stud wall; $^7/_8$″ thick of 1:2; 1:3 Portland cement plaster over metal lath on both sides of wall.	See Note 23	45 min		1		17, 21, 23	$^3/_4$
W-5-W-77	$5^1/_2$″	2″ × 4″ stud wall; 1″ thick neat gypsum plaster over metal lath on both sides of wall; non-load-bearing.	N/A	2 hrs		1		17, 22, 24	2
W-5-W-78	$5^1/_2$″	2″ × 4″ stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster on $^1/_2$″ thick, 0.7 lb./ft^2 wood fiberboard on both sides of wall.	See Note 23	35 min		1		17, 21, 23	$^1/_2$
W-4-W-79	$4^3/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster over wood lath on both sides of wall; mineral wool insulation.	N/A	1 hr			43	21, 31, 35, 38	1
W-4-W-80	$4^3/_4$″	Same as W-4-W-79 but uninsulated.	N/A	35 min			43	21, 31, 35	$^1/_2$
W-4-W-81	$4^3/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 3:1:8; 3:1:12 lime, Keene's cement, sand plaster over wood lath on both sides of wall; mineral wool insulation.	N/A	1 hr			43	21, 31, 35, 40	1
W-4-W-82	$4^3/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:6$^1/_4$; 1:6$^1/_4$ lime Keene's cement plaster over wood lath on both sides of wall; mineral wool insulation.	N/A	30 min			43	21, 31, 35, 40	$^1/_2$
W-4-W-83	$4^3/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:5; 1:7.5 lime plaster over wood lath on both sides of wall.	N/A	30 min			43	21, 31, 35	$^1/_2$
W-5-W-84	$5^1/_8$″	2″ × 4″ wood stud wall; $^{11}/_{16}$″ thick of 1:5; 1:7.5 lime plaster over wood lath on both sides of wall; mineral wool insulation.	N/A	45 min			43	21, 31, 35, 39	$^3/_4$
W-5-W-85	$5^1/_4$″	2″ × 4″ wood stud wall; $^3/_4$″thick of 1:5; 1:7 lime plaster over wood lath on both sides of wall; mineral wool insulation.	N/A	40 min			43	21, 31, 35, 40	$^2/_3$

TABLE 1.3.2—continued
WOOD FRAME WALLS
4″ TO LESS THAN 6″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-5-W-86	$5^1/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 2:1:12 lime, Keene's cement and sand scratch coat; $^1/_2$″ thick 2:1:18 lime, Keene's cement and sand brown coat over wood lath on both sides of wall; mineral wool insulation.	N/A	1 hr			43	21, 31, 35, 40	1
W-5-W-87	$5^1/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster over $^3/_8$″ plaster board on both sides of wall.	N/A	45 min			43	21, 31	$^3/_4$
W-5-W-88	$5^1/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster over $^3/_8$″ gypsum lath on both sides of wall.	N/A	45 min			43	21, 31	$^3/_4$
W-5-W-89	$5^1/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster over $^3/_8$″ gypsum lath on both sides of wall.	N/A	1 hr			43	21, 31, 33	1
W-5-W-90	$5^1/_4$″	2″ × 4 ″ wood stud wall; $^1/_2$″ thick neat plaster over $^3/_8$″ thick gypsum lath on both sides of wall.	N/A	1 hr			43	21, 22, 31	1
W-5-W-91	$5^1/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster over $^3/_8$″ thick indented gypsum lath on both sides of wall.	N/A	45 min			43	21, 31	$^3/_4$
W-5-W-92	$5^1/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster over $^3/_8$″ thick perforated gypsum lath on both sides of wall.	N/A	45 min			43	21, 31, 34	$^3/_4$
W-5-W-93	$5^1/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster over $^3/_8$″ perforated gypsum lath on both sides of wall.	N/A	1 hr			43	21, 31	1
W-5-W-94	$5^1/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster over $^3/_8$″ thick perforated gypsum lath on both sides of wall.	N/A	45 min			43	21, 31, 34	$^3/_4$
W-5-W-95	$5^1/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster over $^1/_2$″ thick wood fiber-board plaster base on both sides of wall.	N/A	35 min			43	21, 31, 36	$^1/_2$
W-5-W-96	$5^3/_4$″	2″ × 4″ wood stud wall; $^1/_2$″ thick of 1:2; 1:2 gypsum plaster over $^7/_8$″ thick flame-proofed wood fiberboard on both sides of wall.	N/A	1 hr			43	21, 31, 37	1

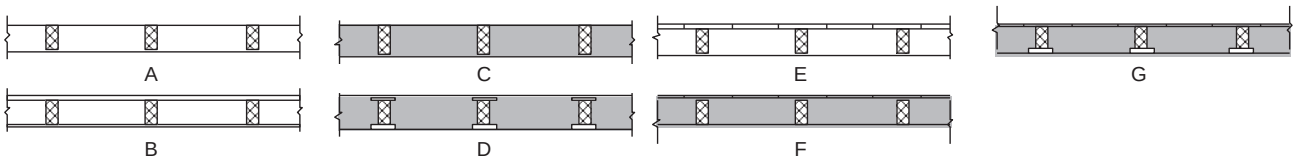
For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 pound per square foot = 47.9 N/m^2.

Notes:

1. All specimens 8 feet or 8 feet 8 inches by 10 feet 4 inches, i.e. one-half of furnace size. See Note 42 for design cross section.
2. Specimens tested in tandem (two per exposure).
3. Test per ASA No. A2-1934, except where unloaded. Also, panels were of "half" size of furnace opening. Time value signifies a thermal failure time.
4. Two-inch by 4-inch studs: 16 inches on center; where 10 feet 4 inches, blocking at 2-foot 4-inch height.
5. Facing 4 feet by 8 feet, cement-asbestos board sheets, $^3/_{16}$ inch thick.
6. Sheathing (diagonal): $^{25}/_{32}$ inch by $5^1/_2$ inch, 1 inch by 6 inches pine.
7. Facing shingles: 24 inches by 12 inches by $^5/_{32}$ inch where used.
8. Asbestos felt: asphalt set between sheathing and shingles.
9. Load: 30,500 pounds or 360 psi/stud where load was tested.
10. Walls were tested beyond achievement of first test end point. A load-bearing time in excess of performance time indicates that, although thermal criteria were exceeded, load-bearing ability continued.
11. Wall was rated for one-hour combustible use in original source.
12. Hose steam test specimen. See table entry of similar design for recommended rating.
13. Rated one and one-fourth hour load bearing. Rated one and one-half hour non-load-bearing.
14. Failed hose stream.
15. Test terminated due to flame penetration.
16. Test terminated—local back face temperature rise.
17. Nominal 2-inch by 4-inch wood studs of No. 1 common or better lumber set edgewise. Two-inch by four-inch plates at top and bottom and blocking at mid-height of wall.
18. Cavity insulation consists of rock wool bats 1.0 lb./ft^2 of filled cavity area.
19. Cavity insulation consists of glass wool bats 0.6 lb./ft^2 of filled cavity area.
20. Cavity insulation consists of blown-in rock wool 2.0 lbs/ft^2 of filled cavity area

TABLE 1.3.2—continued
WOOD FRAME WALLS
4″ TO LESS THAN 6″ THICK

21. Mix proportions for plastered walls as follows: first ratio indicates scratch coat mix, weight of dry plaster to dry sand; second ratio indicates brown coat mix.
22. "Neat" plaster is taken to mean unsanded wood-fiber gypsum plaster.
23. Load: 360 psi of net stud cross-sectional area.
24. Rated as non-load-bearing.
25. Nominal 2-inch by 4-inch studs per Note 17, spaced at 16 inches on center.
26. Horizontal joints in facing material supported by 2-inch by 4-inch blocking within wall.
27. facings secured with 6d casing nails. Nail holes predrilled and were 0.02 to 0.03 inch smaller than nail diameter.
28. Cavity insulation consists of mineral wool bats weighing 2 lbs/ft^2 of filled cavity area.
29. Interior wall face exposed to fire.
30. Exterior wall faced exposed to fire.
31. Nominal 2-inch by 4-inch studs of yellow pine or Douglas-fir spaced 16 inches on center in a single row.
32. Studs as in Note 31 except double row, with studs in rows staggered.
33. Six roofing nails with metal-lath pads around heads to each 16-inch by 48-inch lath.
34. Areas of holes less than $2^3/_4$ percent of area of lath.
35. Wood laths were nailed with either 3d or 4d nails, one nail to each bearing, and the end joining broken every seventh course.
36. One-half-inch thick fiberboard plaster base nailed with 3d or 4d common wire nails spaced 4 to 6 inches on center.
37. Seven-eighths-inch thick fiberboard plaster base nailed with 5d common wire nails spaced 4 to 6 inches on center.
38. Mineral wood bats 1.05 to 1.25 lbs/ft^2 with waterproofed-paper backing.
39. Blown-in mineral wool insulation, 2.2 lbs/ft^2.
40. Mineral wool bats, 1.4 lbs/ft^2 with waterproofed-paper backing.
41. Mineral wood bats, 0.9 lb./ft^2.
42. See wall design diagram below:



43. Duplicate specimen of W-4-W-7, tested simultaneously with W-4-W-7 in 18-foot test furnace.

TABLE 1.3.3
WOOD FRAME WALLS
6″ TO LESS THAN 8″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-6-W-1	$6^1/_4$″	2″ × 4″ stud wall; $^1/_2$″ thick, 1:2; 1:2 gypsum plaster on $^7/_8$″ flameproofed wood fiberboard weighing 2.8 lbs/ft^2 on both sides of wall.	See Note 3	1 hr		1		1–3	1
W-6-W-2	$6^1/_2$″	2″ × 4″ stud wall; $^1/_2$″ thick, 1:3; 1:3 gypsum plaster on 1″ thick magnesium oxysulfate wood fiberboard on both sides of wall.	See Note 3	45 min		1		1–3	$^3/_4$
W-7-W-3	$7^1/_4$″	Double row of 2″ × 4″ studs, $^1/_2$″ thick of 1:2; 1:2 gypsum plaster applied over $^3/_8$″ thick perforated gypsum lath on both sides of wall; mineral wool insulation.	N/A	1 hr			43	2, 4, 5	1
W-7-W-4	$7^1/_2$″	Double row of 2″ × 4″ studs, $^5/_8$″ thick of 1:2; 1:2 gypsum plaster applied over $^3/_8$″ thick perforated gypsum lath over laid with 2″ × 2″, 16 gage wire fabric, on both sides of wall.	N/A	1 hr 15 min			43	2, 4	$1^1/_4$

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 pound per square foot = 47.9 N/m^2.

Notes:

1. Nominal 2-inch by 4-inch wood studs of No. 1 common or better lumber set edgewise. Two-inch by 4-inch plates at top and bottom and blocking at mid height of wall.
2. Mix proportions for plastered walls as follows: first ratio indicates scratch coat mix, weight of dry plaster to dry sand; second ratio indicates brown coat mix.
3. Load: 360 psi of net stud cross-sectional area.
4. Nominal 2-inch by 4-inch studs of yellow pine of Douglas-fir spaced 16 inches in a double row, with studs in rows staggered.
5. Mineral wool bats, 0.19 lb./ft^2.

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TABLE 1.4.1
MISCELLANEOUS MATERIALS WALLS
0″ TO LESS THAN 4″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-3-Mi-1	$3^{7}/_{8}$″	Glass brick wall: (bricks $5^{3}/_{4}$″ × $5^{3}/_{4}$″ × $3^{7}/_{8}$″) $^{1}/_{4}$″ mortar bed, cement/lime/sand; mounted in brick (9″) wall with mastic and $^{1}/_{2}$″ asbestos rope.	N/A	1 hr			7	1, 2	1
W-3-Mi-2	3″	Core: 2″ magnesium oxysulfate wood-fiber blocks laid in Portland cement-lime mortar; facings: on both sides; see Note 3.	N/A	1 hr		1		3	1
W-3-Mi-3	$3^{7}/_{8}$″	Core: 8″ × $4^{7}/_{8}$″ glass blocks $3^{7}/_{8}$″ thick weighing 4 lbs each laid in Portland cement-lime mortar; horizontal mortar joints reinforced with metal lath.	N/A	15 min		1			$^{1}/_{4}$

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN.

Notes:

1. No failure reached at 1 hour.
2. These glass blocks are assumed to be solid based on other test data available for similar but hollow units which show significantly reduced fire endurance.
3. Minimum of $^{1}/_{2}$ inch of 1:3 sanded gypsum plaster required to develop this rating.

TABLE 1.4.2
MISCELLANEOUS MATERIALS WALLS
4″ TO LESS THAN 6″ THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-Mi-1	4″	Core: 3″ magnesium oxysulfate wood-fiber blocks laid in Portland cement mortar; facings: both sides; see Note 1.	N/A	2 hrs		1			2

For SI: 1 inch = 25.4 mm.

Notes:

1. One-half inch sanded gypsum plaster. Voids in hollow blocks to be not more than 30 percent.

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FIGURE 1.5.1
FINISH RATINGS—INORGANIC MATERIALS

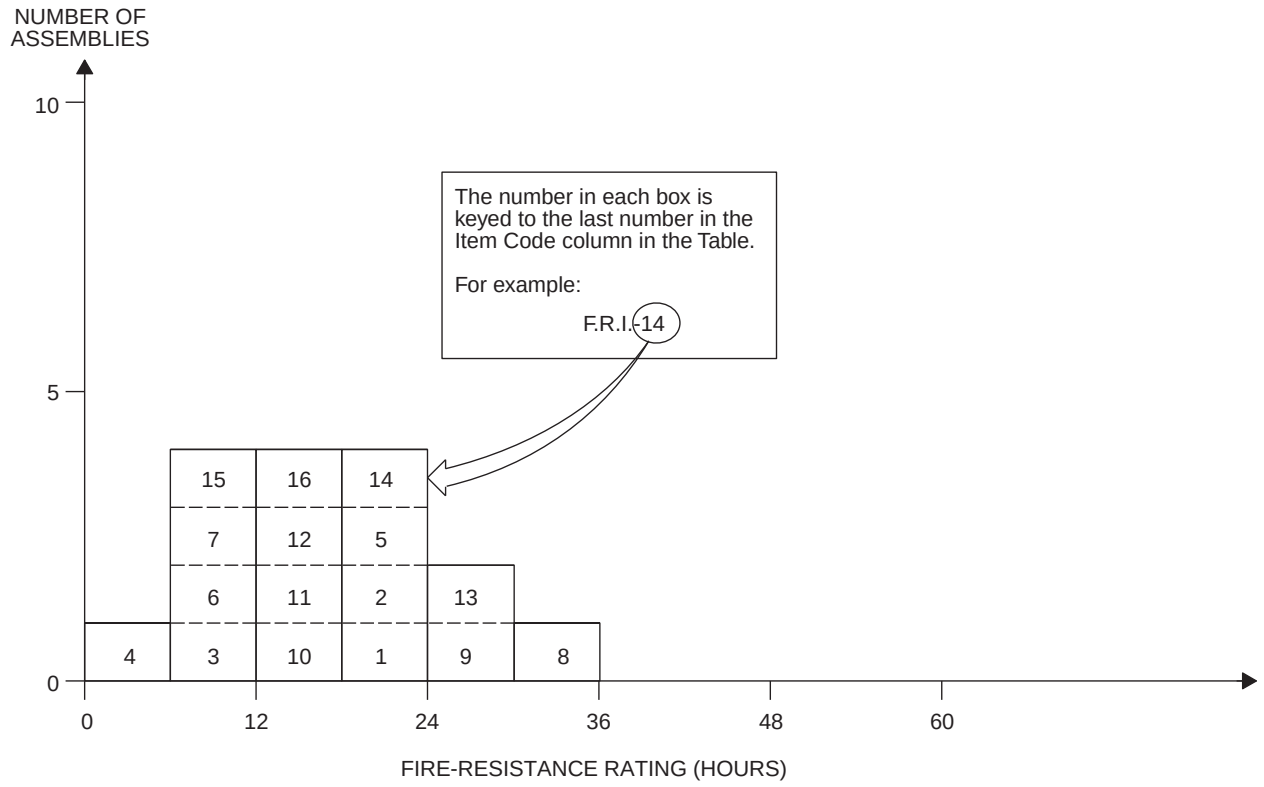

TABLE 1.5.1
FINISH RATINGS—INORGANIC MATERIALS

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE	REFERENCE NUMBER			NOTES	REC F.R. (MIN)
			FINISH RATING	PRE-BMS-92	BMS-92	POST-BMS-92		
FR-I-1	$^{9}/_{16}$″	$^{3}/_{8}$″ gypsum wallboard faced with $^{3}/_{16}$″ cement-asbestos board.	20 minutes		1		1, 2	15
FR-I-2	$^{11}/_{16}$″	$^{1}/_{2}$″ gypsum sheathing faced with $^{3}/_{16}$″ cement-asbestos board.	20 minutes		1		1, 2	20
FR-I-3	$^{3}/_{16}$″	$^{3}/_{16}$″ cement-asbestos board over uninsulated cavity.	10 minutes		1		1, 2	5
FR-I-4	$^{3}/_{16}$″	$^{3}/_{16}$″ cement-asbestos board over insulated cavities.	5 minutes		1		1, 2	5
FR-I-5	$^{3}/_{4}$″	$^{3}/_{4}$″ thick 1:2; 1:3 gypsum plaster over paper-backed metal lath.	20 minutes		1		1–3	20
FR-I-6	$^{3}/_{4}$″	$^{3}/_{4}$″ thick Portland cement plaster on metal lath.	10 minutes		1		1, 2	10
FR-I-7	$^{3}/_{4}$″	$^{3}/_{4}$″ thick 1:5; 1:7.5 lime plaster on metal lath.	10 minutes		1		1, 2	10
FR-I-8	1″	1″ thick neat gypsum plaster on metal lath.	35 minutes		1		1, 2, 4	35
FR-I-9	$^{3}/_{4}$″	$^{3}/_{4}$″ thick neat gypsum plaster on metal lath.	30 minutes		1		1, 2, 4	30
FR-I-10	$^{3}/_{4}$″	$^{3}/_{4}$″ thick 1:2; 1:2 gypsum plaster on metal lath.	15 minutes		1		1–3	15
FR-I-11	$^{1}/_{2}$″	Same as FR-1-7, except $^{1}/_{2}$″ thick on wood lath.	15 minutes		1		1–3	15

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TABLE 1.5.1—continued
FINISH RATINGS—INORGANIC MATERIALS

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE	REFERENCE NUMBER			NOTES	REC F.R. (MIN)
			LOAD	PRE-BMS-92	BMS-92	POST-BMS-92		
FR-I-12	1/2″	1/2″ thick 1:2; 1:3 gypsum plaster on wood lath.	15 minutes		1		1–3	15
FR-I-13	7/8″	1/2″ thick 1:2; 1:2 gypsum plaster on 3/8″ perforated gypsum lath.	30 minutes		1		1–3	30
FR-I-14	7/8″	1/2″ thick 1:2; 1:2 gypsum plaster on 3/8″ thick plain or indented gypsum plaster.	20 minutes		1		1–3	20
FR-I-15	3/8″	3/8″ gypsum wallboard.	10 minutes		1		1, 2	10
FR-I-16	1/2″	1/2″ gypsum wallboard.	15 minutes		1		1, 2	15

For SI: 1 inch = 25.4 mm, °C = [(°F) - 32]/1.8.

Notes:

1. The finish rating is the time required to obtain an average temperature rise of 250°F, or a single point rise of 325°F, at the interface between the material being rated and the substrate being protected.
2. Tested in accordance with the *Standard Specifications for Fire Tests of Building Construction and Materials*, ASA No. A2-1932.
3. Mix proportions for plasters as follows: first ratio, dry weight of plaster to dry weight of sand for scratch coat; second ratio, plaster to sand for brown coat.
4. Neat plaster means unsanded wood-fiber gypsum plaster.

TABLE 1.5.2
FINISH RATINGS—ORGANIC MATERIALS

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE	REFERENCE NUMBER			NOTES	REC. F.R. (min)
			FINISH RATING	PRE-BMS-92	BMS-92	POST-BMS-92		
FR-O-1	9/16″	7/16″ wood fiberboard faced with 1/8″ cement-asbestos board.	15 minutes		1		1, 2	15
FR-O-2	29/32″	3/4″ wood sheathing, asbestos felt weighing 14 lbs/100 ft^2 and 5/32″ cement-asbestos shingles.	20 minutes		1		1, 2	20
FR-O-3	1 1/2″	1″ thick magnesium oxysulfate wood fiberboard faced with 1:3; 1:3 gypsum plaster, 1/2″ thick.	20 minutes		1		1–3	20
FR-O-4	1/2″	1/2″ thick wood fiberboard.	5 minutes		1		1, 2	5
FR-O-5	1/2″	1/2″ thick flameproofed wood fiberboard.	10 minutes		1		1, 2	10
FR-O-6	1″	1/2″ thick wood fiberboard faced with 1/2″ thick 1:2; 1:2 gypsum plaster.	15 minutes		1		1–3	15
FR-O-7	1 3/8″	7/8″ thick flameproofed wood fiberboard faced with 1/2″ thick 1:2; 1:2 gypsum plaster.	30 minutes		1		1–3	30
FR-O-8	1 1/4″	1 1/4″ thick plywood.	30 minutes			35		30

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square foot = 47.9 N/m^2, °C = [(°F) - 32]/1.8.

Notes:

1. The finish rating is the time required to obtain an average temperature rise of 250°F, or a single point rise of 325°F, at the interface between the material being rated and he substrate being protected.
2. Tested in accordance with the *Standard Specifications for Fire Tests of Building Construction and Materials*, ASA No. A2-1932.
3. Plaster ratios as follows: first ratio is for scratch coat, weight of dry plaster to weight of dry sand; second ratio is for the brown coat.

General Note:

The finish rating of thinner materials, particularly thinner woods, have not been listed because the possible effects of shrinkage, warpage and aging cannot be predicted.

SECTION II—COLUMNS

TABLE 2.1.1
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 0″ TO LESS THAN 6″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-6-RC-1	6″	6″ × 6″ square columns; gravel aggregate concrete (4030 psi); reinforcement: vertical, four $^{7}/_{8}$″ rebars; horizontal, $^{5}/_{16}$″ ties at 6″ pitch; cover: 1″.	34.7 tons	1 hr 2 min			7	1, 2	1
C-6-RC-2	6″	6″ × 6″ square columns; gravel aggregate concrete (4200 psi); reinforcement: vertical, four $^{1}/_{2}$″ rebars; horizontal, $^{5}/_{16}$″ ties at 6″ pitch; cover: 1″.	21 tons	1 hr 9 min			7	1, 2	1

Notes:
1. Collapse.
2. British test.

FIGURE 2.1.2
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 10″ TO LESS THAN 12″

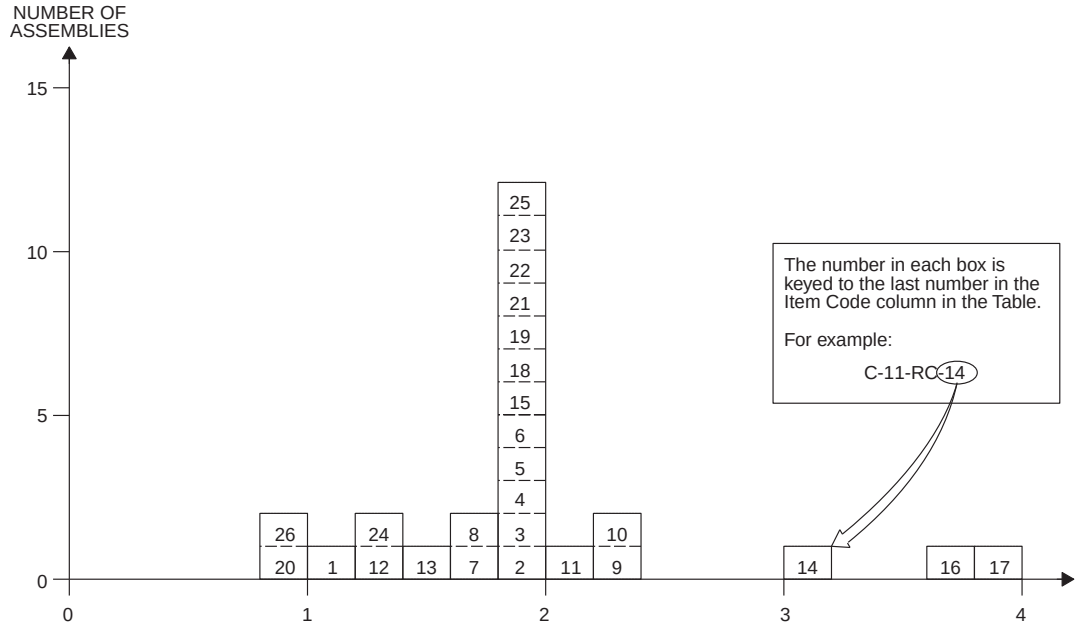

TABLE 2.1.2
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 10″ TO LESS THAN 12″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST- BMS-92		
C-10-RC-1	10″	10″ square columns; aggregate concrete (4260 psi); reinforcement: vertical, four $1^{1}/_{4}$″ rebars; horizontal, $^{3}/_{8}$″ ties at 6″ pitch; cover: $1^{1}/_{4}$″.	92.2 tons	1 hr 2 min			7	1	1
C-10-RC-2	10″	10″ square columns; aggregate concrete (2325 psi); reinforcement: vertical, four $^{1}/_{2}$″ rebars; horizontal, $^{5}/_{16}$″ ties at 6″ pitch; cover: 1″.	46.7 tons	1 hr 52 min			7	1	$1^{3}/_{4}$

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TABLE 2.1.2—continued
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 10″ TO LESS THAN 12″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST- BMS-92		
C-10-RC-3	10″	10″ square columns; aggregate concrete (5370 psi); reinforcement: vertical, four $^{1}/_{2}$″ rebars; horizontal, $^{5}/_{16}$″ ties at 6″ pitch; cover: 1″.	46.5 tons	2 hrs			7	2, 3, 11	2
C-10-RC-4	10″	10″ square columns; aggregate concrete (5206 psi); reinforcement: vertical, four $^{1}/_{2}$″ rebars; horizontal, $^{5}/_{16}$″ ties at 6″ pitch; cover: 1″.	46.5 tons	2 hrs			7	2, 7	2
C-10-RC-5	10″	10″ square columns; aggregate concrete (5674 psi); reinforcement: vertical, four $^{1}/_{2}$″ rebars; horizontal, $^{5}/_{16}$″ ties at 6″ pitch; cover: 1″.	46.7 tons	2 hrs			7	1	2
C-10-RC-6	10″	10″ square columns; aggregate concrete (5150 psi); reinforcement: vertical, four $1^{1}/_{2}$″ rebars; horizontal, $^{5}/_{16}$″ ties at 6″ pitch; cover: 1″.	66 tons	1 hr 43 min			7	1	$1^{3}/_{4}$
C-10-RC-7	10″	10″ square columns; aggregate concrete (5580 psi); reinforcement: vertical, four $^{1}/_{2}$″ rebars; horizontal, $^{5}/_{16}$″ ties at 6″ pitch; cover: $1^{1}/_{8}$″.	62.5 tons	1 hr 38 min			7	1	$1^{1}/_{2}$
C-10-RC-8	10″	10″ square columns; aggregate concrete (4080 psi); reinforcement: vertical, four $1^{1}/_{8}$″ rebars; horizontal, $^{5}/_{16}$″ ties at 6″ pitch; cover: $1^{1}/_{8}$″.	72.8 tons	1 hr 48 min			7	1	$1^{3}/_{4}$
C-10-RC-9	10″	10″ square columns; aggregate concrete (2510 psi); reinforcement: vertical, four $^{1}/_{2}$″ rebars; horizontal, $^{5}/_{16}$″ ties at 6″ pitch; cover: 1″.	51 tons	2 hrs 16 min			7	1	$2^{1}/_{4}$
C-10-RC-10	10″	10″ square columns; aggregate concrete (2170 psi); reinforcement: vertical, four $^{1}/_{2}$″ rebars; horizontal, $^{5}/_{16}$″ ties at 6″ pitch; cover: 1″.	45 tons	2 hrs 14 min			7	12	$2^{1}/_{4}$
C-10-RC-11	10″	10″ square columns; gravel aggregate concrete (4015 psi); reinforcement: vertical, four $^{1}/_{2}$″ rebars; horizontal, $^{5}/_{16}$″ ties at 6″ pitch; cover: 1″.	46.5 tons	2 hrs 6 min			7	1	2
C-11-RC-12	11″	11″ square columns; gravel aggregate concrete (4150 psi); reinforcement: vertical, four $1^{1}/_{4}$″ rebars; horizontal, $^{3}/_{8}$″ ties at $7^{1}/_{2}$″ pitch; cover: $1^{1}/_{2}$″.	61 tons	1 hr 23 min			7	1	$1^{1}/_{4}$
C-11-RC-13	11″	11″ square columns; gravel aggregate concrete (4380 psi); reinforcement: vertical, four $1^{1}/_{4}$″ rebars; horizontal, $^{3}/_{8}$″ ties at $7^{1}/_{2}$″ pitch; cover: $1^{1}/_{2}$″.	61 tons	1 hr 26 min			7	1	$1^{1}/_{4}$
C-11-RC-14	11″	11″ square columns; gravel aggregate concrete (4140 psi); reinforcement: vertical, four $1^{1}/_{4}$″ rebars; horizontal, $^{3}/_{8}$″ ties at $7^{1}/_{2}$″ pitch; steel mesh around reinforcement; cover: $1^{1}/_{2}$″.	61 tons	3 hrs 9 min			7	1	3
C-11-RC-15	11″	11″ square columns; slag aggregate concrete (3690 psi); reinforcement: vertical, four $1^{1}/_{4}$″ rebars; horizontal, $^{3}/_{8}$″ ties at $7^{1}/_{2}$″ pitch; cover: $1^{1}/_{2}$″.	91 tons	2 hrs			7	2–5	2
C-11-RC-16	11″	11″ square columns; limestone aggregate concrete (5230 psi); reinforcement: vertical, four $1^{1}/_{4}$″ rebars; horizontal, $^{3}/_{8}$″ ties at $7^{1}/_{2}$″ pitch; cover: $1^{1}/_{2}$″.	91.5 tons	3 hrs 41 min			7	1	$3^{1}/_{2}$
C-11-RC-17	11″	11″ square columns; limestone aggregate concrete (5530 psi); reinforcement: vertical, four $1^{1}/_{4}$″ rebars; horizontal, $^{3}/_{8}$″ ties at $7^{1}/_{2}$″ pitch; cover: $1^{1}/_{2}$″.	91.5 tons	3 hrs 47 min			7	1	$3^{1}/_{2}$

TABLE 2.1.2—continued
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 10″ TO LESS THAN 12″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST- BMS-92		
C-11-RC-18	11″	11″ square columns; limestone aggregate concrete (5280 psi); reinforcement: vertical, four $1^1/_4$″ rebars; horizontal, $^3/_8$″ ties at $7^1/_2$″ pitch; cover: $1^1/_2$″.	91.5 tons	2 hrs			7	2–4, 6	2
C-11-RC-19	11″	11″ square columns; limestone aggregate concrete (4180 psi); reinforcement: vertical, four $^5/_8$″ rebars; horizontal, $^3/_8$″ ties at 7″ pitch; cover: $1^1/_2$″.	71.4 tons	2 hrs			7	2, 7	2
C-11-RC-20	11″	11″ square columns; gravel concrete (4530 psi); reinforcement: vertical, four $^5/_8$″ rebars; horizontal, $^3/_8$″ ties at 7″ pitch; cover: $1^1/_2$″ with $^1/_2$″ plaster.	58.8 tons	2 hrs			7	2, 3, 9	2
C-11-RC-21	11″	11″ square columns; gravel concrete (3520 psi); reinforcement: vertical, four $^5/_8$″ rebars; horizontal, $^3/_8$″ ties at 7″ pitch; cover: $1^1/_2$″.	Variable	1 hr 24 min			7	1, 8	$1^1/_4$
C-11-RC-22	11″	11″ square columns; aggregate concrete (3710 psi); reinforcement: vertical, four $^5/_8$″ rebars; horizontal, $^3/_8$″ ties at 7″ pitch; cover: $1^1/_2$″.	58.8 tons	2 hrs			7	2, 3, 10	2
C-11-RC-23	11″	11″ square columns; aggregate concrete (3190 psi); reinforcement: vertical, four $^5/_8$″ rebars; horizontal, $^3/_8$″ ties at 7″ pitch; cover: $1^1/_2$″.	58.8 tons	2 hrs			7	2, 3, 10	2
C-11-RC-24	11″	11″ square columns; aggregate concrete (4860 psi); reinforcement: vertical, four $^5/_8$″ rebars; horizontal, $^3/_8$″ ties at 7″ pitch; cover: $1^1/_2$″.	86.1 tons	1 hr 20 min			7	1	$1^1/_3$
C-11-RC-25	11″	11″ square columns; aggregate concrete (4850 psi); reinforcement: vertical, four $^5/_8$″ rebars; horizontal, $^3/_8$″ ties at 7″ pitch; cover: $1^1/_2$″.	58.8 tons	1 hr 59 min			7	1	$1^3/_4$
C-11-RC-26	11″	11″ square columns; aggregate concrete (3834 psi); reinforcement: vertical, four $^5/_8$″ rebars; horizontal, $^5/_{16}$″ ties at $4^1/_2$″ pitch; cover: $1^1/_2$″.	71.4 tons	53 min			7	1	$^3/_4$

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Failure mode—collapse.
2. Passed 2-hour fire exposure.
3. Passed hose stream test.
4. Reloaded effectively after 48 hours but collapsed at load in excess of original test load.
5. Failing load was 150 tons.
6. Failing load was 112 tons.
7. Failed during hose stream test.
8. Range of load 58.8 tons (initial) to 92 tons (92 minutes) to 60 tons (80 minutes).
9. Collapsed at 44 tons in reload after 96 hours.
10. Withstood reload after 72 hours.
11. Collapsed on reload after 48 hours.

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TABLE 2.1.3
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 12″ TO LESS THAN 14″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-RC-1	12″	12″ square columns; gravel aggregate concrete (2647 psi); reinforcement: vertical, four $^5/_8$″ rebars; horizontal, $^5/_{16}$″ ties at 4$^1/_2$″ pitch; cover: 2″.	78.2 tons	38 min		1	7	1	$^1/_2$
C-12-RC-2	12″	Reinforced columns with 1$^1/_2$″ concrete outside of reinforced steel; gross diameter or side of column: 12″; Group I, Column A.	—	6 hrs		1		2, 3	6
C-12-RC-3	12″	Description as per C-12-RC-2; Group I, Column B.	—	4 hrs		1		2, 3	4
C-12-RC-4	12″	Description as per C-12-RC-2; Group II, Column A.	—	4 hrs		1		2, 3	4
C-12-RC-5	12″	Description as per C-12-RC-2; Group II, Column B.	—	2 hrs 30 min		1		2, 3	2$^1/_2$
C-12-RC-6	12″	Description as per C-12-RC-2; Group III, Column A.	—	3 hrs		1		2, 3	3
C-12-RC-7	12″	Description as per C-12-RC-2; Group III, Column B.	—	2 hrs		1		2, 3	2
C-12-RC-8	12″	Description as per C-12-RC-2; Group IV, Column A.	—	2 hrs		1		2, 3	2
C-12-RC-9	12″	Description as per C-12-RC-2; Group IV, Column B.	—	1 hr 30 min		1		2, 3	1$^1/_2$

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m^2.

Notes:

1. Failure mode—unspecified structural.
2. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
   Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs/yd^2, placed not more than 1 inch from the surface of the concrete.
   Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs/yd^2, placed not more than 1 inch from the surface of the concrete.
   Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.
3. Groupings of aggregates and ties are the same as for structural steel columns protected solidly with concrete, the ties to be placed over the vertical reinforcing bars and the mesh where required, to be placed within 1 inch from the surface of the column.
   Column A: working loads are assumed as carried by the area of the column inside of the lines circumscribing the reinforcing steel.
   Column B: working loads are assumed as carried by the gross area of the column.

TABLE 2.1.4
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 14″ TO LESS THAN 16″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE- BMS-92	BMS-92	POST- BMS-92		
C-14-RC-1	14″	14″ square columns; gravel aggregate concrete (4295 psi); reinforcement: vertical four $^3/_4$″ rebars; horizontal: $^1/_4$″ ties at 9″ pitch; cover: 1$^1/_2$″	86 tons	1 hr 22 min			7	1	1$^1/_4$
C-14-RC-2	14″	Reinforced concrete columns with 1$^1/_2$″ concrete outside reinforcing steel; gross diameter or side of column: 14″; Group I, Column A.	—	7 hrs		1		2, 3	7
C-14-RC-3	14″	Description as per C-14-RC-2; Group I, Column B.	—	5 hrs		1		2, 3	5
C-14-RC-4	14″	Description as per C-14-RC-2; Group II, Column A.	—	5 hrs		1		2, 3	5
C-14-RC-5	14″	Description as per C-14-RC-2; Group II, Column B.	—	3 hrs 30 min		1		2, 3	3$^1/_2$
C-14-RC-6	14″	Description as per C-14-RC-2; Group III, Column A.	—	4 hrs		1		2, 3	4
C-14-RC-7	14″	Description as per C-14-RC-2; Group III, Column B.	—	2 hrs 30 min		1		2, 3	2$^1/_2$

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TABLE 2.1.4—continued
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 14″ TO LESS THAN 16″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE- BMS-92	BMS-92	POST- BMS-92		
C-14-RC-8	14″	Description as per C-14-RC-2; Group IV, Column A.	—	2 hrs 30 min		1		2, 3	$2^1/_2$
C-14-RC-9	14″	Description as per C-14-RC-2; Group IV, Column B.	—	1 hr 30 min		1		2, 3	$1^1/_2$

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m^2.

Notes:

1. Failure mode—main rebars buckled between links at various points.
2. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
   Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs/yd^2, placed not more than 1 inch from the surface of the concrete.
   Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs/yd^2, placed not more than 1 inch from the surface of the concrete.
   Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.
3. Groupings of aggregates and ties are the same as for structural steel columns protected solidly with concrete, the ties to be placed over the vertical reinforcing bars and the mesh where required, to be placed within 1 inch from the surface of the column.
   Column A: working loads are assumed as carried by the area of the column inside of the lines circumscribing the reinforcing steel.
   Column B: working loads are assumed as carried by the gross area of the column.

FIGURE 2.1.5
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 16″ TO LESS THAN 18″

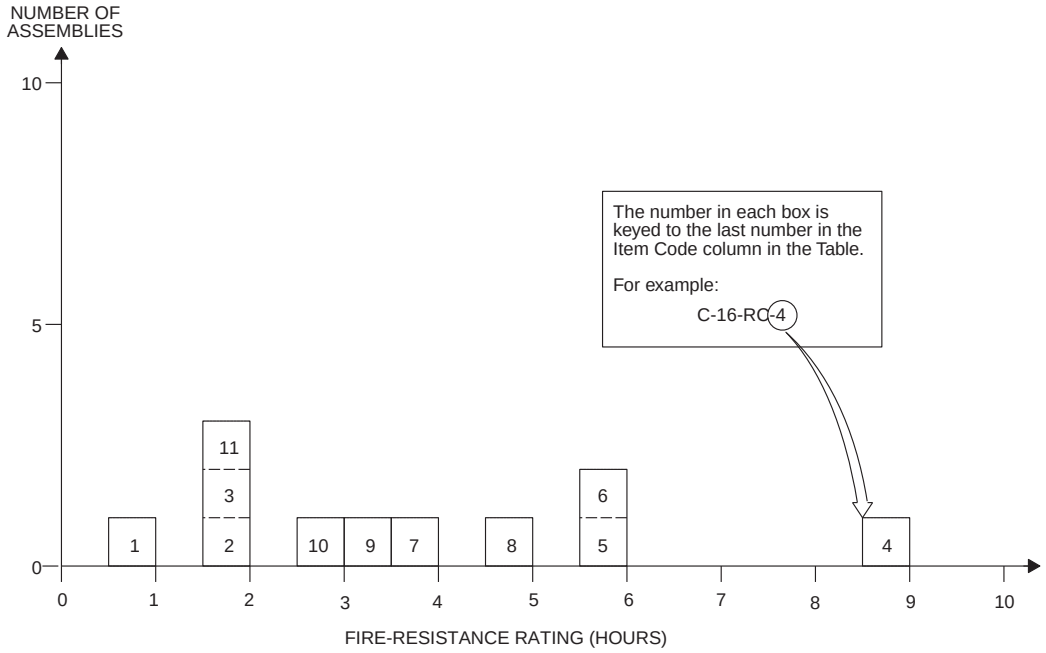

TABLE 2.1.5
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 16″ TO LESS THAN 18″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-16-RC-1	16″	16″ square columns; gravel aggregate concrete (4550 psi); reinforcement: vertical, eight $1^3/_8$″ rebars; horizontal, $^5/_{16}$″ ties at 6″ pitch $1^3/_8$″ below column surface and $^5/_{16}$″ ties at 6″ pitch linking center rebars of each face forming a smaller square in column cross section.	237 tons	1 hr			7	1–3	1

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TABLE 2.1.5—continued
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 16″ TO LESS THAN 18″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-16-RC-2	16″	16″ square columns; gravel aggregate concrete (3360 psi); reinforcement: vertical, eight $1^3/_8$″ rebars; horizontal, $^5/_{16}$″ ties at 6″ pitch; cover: $1^3/_8$″.	210 tons	2 hrs			7	2, 4–6	2
C-16-RC-3	16″	16″ square columns; gravel aggregate concrete (3980 psi); reinforcement: vertical, four $^7/_8$″ rebars; horizontal, $^3/_8$″ ties at 6″ pitch; cover: 1″.	123.5 tons	2 hrs			7	2, 4, 7	2
C-16-RC-4	16″	Reinforced concrete columns with $1^1/_2$″ concrete outside reinforcing steel; gross diameter or side of column: 16″; Group I, Column A.	—	9 hrs		1		8, 9	9
C-16-RC-5	16″	Description as per C-16-RC-4; Group I, Column B.	—	6 hrs		1		8, 9	6
C-16-RC-6	16″	Description as per C-16-RC-4; Group II, Column A.	—	6 hrs		1		8, 9	6
C-16-RC-7	16″	Description as per C-16-RC-4; Group II, Column B.	—	4 hrs		1		8, 9	4
C-16-RC-8	16″	Description as per C-16-RC-4; Group III, Column A.	—	5 hrs		1		8, 9	5
C-16-RC-9	16″	Description as per C-16-RC-4; Group III, Column B.	—	3 hrs 30 min		1		8, 9	$3^1/_2$
C-16-RC-10	16″	Description as per C-16-RC-4; Group IV, Column A.	—	3 hrs		1		8, 9	3
C-16-RC-11	16″	Description as per C-16-RC-4; Group IV, Column B.	—	2 hrs		1		8, 9	2

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m^2.

Notes:

1. Column passed 1-hour fire test.
2. Column passed hose stream test.
3. No reload specified.
4. Column passed 2-hour fire test.
5. Column reloaded successfully after 24 hours.
6. Reinforcing details same as C-16-RC-1.
7. Column passed reload after 72 hours.
8. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
   Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs/yd^2, placed not more than 1 inch from the surface of the concrete.
   Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs/yd^2, placed not more than 1 inch from the surface of the concrete.
   Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.
9. Groupings of aggregates and ties are the same as for structural steel columns protected solidly with concrete, the ties to be placed over the vertical reinforcing bars and the mesh where required, to be placed within 1 inch from the surface of the column.
   Column A: working loads are assumed as carried by the area of the column inside of the lines circumscribing the reinforcing steel.
   Column B: working loads are assumed as carried by the gross area of the column.

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TABLE 2.1.6
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 18″ TO LESS THAN 20″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE- BMS-92	BMS-92	POST- BMS-92		
C-18-RC-1	18″	Reinforced concrete columns with $1^1/_2$″ concrete outside reinforced steel; gross diameter or side of column: 18″; Group I, Column A.	—	11 hrs		1		1, 2	11
C-18-RC-2	18″	Description as per C-18-RC-1; Group I, Column B.	—	8 hrs		1		1, 2	8
C-18-RC-3	18″	Description as per C-18-RC-1; Group II, Column A.	—	7 hrs		1		1, 2	7
C-18-RC-4	18″	Description as per C-18-RC-1; Group II, Column B.	—	5 hrs		1		1, 2	5
C-18-RC-5	18″	Description as per C-18-RC-1; Group III, Column A.	—	6 hrs		1		1, 2	6
C-18-RC-6	18″	Description as per C-18-RC-1; Group III, Column B.	—	4 hrs		1		1, 2	4
C-18-RC-7	18″	Description as per C-18-RC-1; Group IV, Column A.	—	3 hrs 30 min		1		1, 2	$3^1/_2$
C-18-RC-8	18″	Description as per C-18-RC-1; Group IV, Column B.	—	2 hrs 30 min		1		1, 2	$2^1/_2$

For SI: 1 inch = 25.4 mm, 1 pound per square yard = 5.3 N/m^2.

Notes:

1. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
   Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs/yd^2, placed not more than 1 inch from the surface of the concrete.
   Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs/yd^2, placed not more than 1 inch from the surface of the concrete.
   Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint and, tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.
2. Groupings of aggregates and ties are the same as for structural steel columns protected solidly with concrete, the ties to be placed over the vertical reinforcing bars and the mesh where required, to be placed within 1 inch from the surface of the column.
   Column A: working loads are assumed as carried by the area of the column inside of the lines circumscribing the reinforcing steel.
   Column B: working loads are assumed as carried by the gross area of the column.

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FIGURE 2.1.7
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 20″ TO LESS THAN 22″

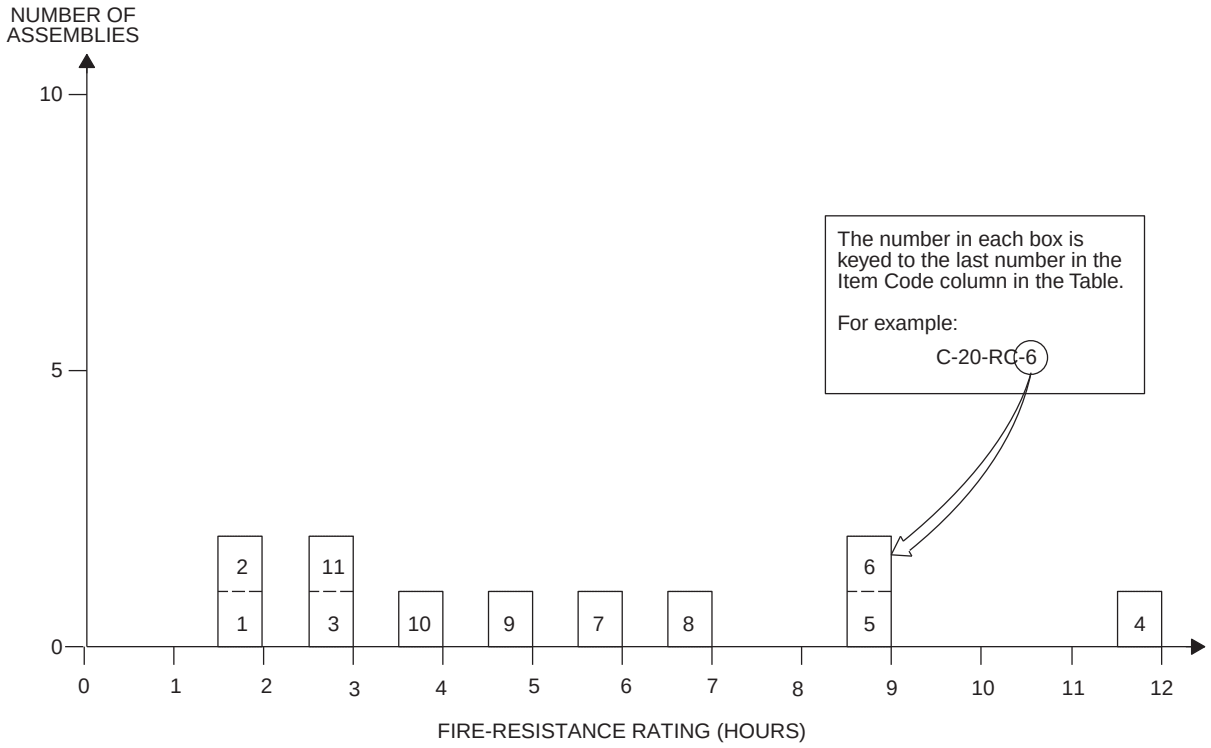

TABLE 2.1.7
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 20″ TO LESS THAN 22″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-20-RC-1	20″	20″ square columns; gravel aggregate concrete (6690 psi); reinforcement: vertical, four $1^{3}/_{4}$″ rebars; horizontal, $^{3}/_{8}$″ wire at 6″ pitch; cover $1^{3}/_{4}$″.	367 tons	2 hrs			7	1–3	2
C-20-RC-2	20″	20″ square columns; gravel aggregate concrete (4330 psi); reinforcement: vertical, four $1^{3}/_{4}$″ rebars; horizontal, $^{3}/_{8}$″ ties at 6″ pitch; cover $1^{3}/_{4}$″.	327 tons	2 hrs			7	1, 2, 4	2
C-20-RC-3	$20^{1}/_{4}$″	20″ square columns; gravel aggregate concrete (4230 psi); reinforcement: vertical, four $1^{1}/_{8}$″ rebars; horizontal, $^{3}/_{8}$″ wire at 5″ pitch; cover $1^{1}/_{8}$″.	199 tons	2 hrs 56 min			7	5	$2^{3}/_{4}$
C-20-RC-4	20″	Reinforced concrete columns with $1^{1}/_{2}$″ concrete outside of reinforcing steel; gross diameter or side of column: 20″; Group I, Column A.	—	12 hrs		1		6, 7	12
C-20-RC-5	20″	Description as per C-20-RC-4; Group I, Column B.	—	9 hrs		1		6, 7	9
C-20-RC-6	20″	Description as per C-20-RC-4; Group II, Column A.	—	9 hrs		1		6, 7	9
C-20-RC-7	20″	Description as per C-20-RC-4; Group II, Column B.	—	6 hrs		1		6, 7	6
C-20-RC-8	20″	Description as per C-20-RC-4; Group III, Column A.	—	7 hrs		1		6, 7	7

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TABLE 2.1.7—continued
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 20″ TO LESS THAN 22″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-20-RC-9	20″	Description as per C-20-RC-4; Group III, Column B.	—	5 hrs		1		6, 7	5
C-20-RC-10	20″	Description as per C-20-RC-4; Group IV, Column A.	—	4 hrs		1		6, 7	4
C-20-RC-11	20″	Description as per C-20-RC-4; Group IV, Column B.	—	3 hrs		1		6, 7	3

For SI: 1 inch = 25.4 mm, 1 pound per square yard = 5.3 N/m^2, 1 ton = 8.896 kN.

Notes:

1. Passed 2-hour fire test.
2. Passed hose stream test.
3. Failed during reload at 300 tons.
4. Passed reload after 72 hours.
5. Failure mode—collapse.
6. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
   Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs/yd^2, placed not more than 1 inch from the surface of the concrete.
   Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs/yd^2, placed not more than 1 inch from the surface of the concrete.
   Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.
7. Groupings of aggregates and ties are the same as for structural steel columns protected solidly with concrete, the ties to be placed over the vertical reinforcing bars and the mesh where required, to be placed within 1 inch from the surface of the column.
   Column A: working loads are assumed as carried by the area of the column inside of the lines circumscribing the reinforcing steel.
   Column B: working loads are assumed as carried by the gross area of the column.

TABLE 2.1.8
HEXAGONAL REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 12″ TO LESS THAN 14″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-HRC-1	12″	12″ hexagonal columns; gravel aggregate concrete (4420 psi); reinforcement: vertical, eight $^1/_2$″ rebars; horizontal, $^5/_{16}$″ helical winding at 1$^1/_2$″ pitch; cover: $^1/_2$″.	88 tons	58 min			7	1	$^3/_4$
C-12-HRC-2	12″	12″ hexagonal columns; gravel aggregate concrete (3460 psi); reinforcement: vertical, eight $^1/_2$″ rebars; horizontal, $^5/_{16}$″ helical winding at 1$^1/_2$″ pitch; cover: $^1/_2$″.	78.7 tons	1 hr			7	2	1

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Failure mode—collapse.
2. Test stopped at 1 hour.

TABLE 2.1.9
HEXAGONAL REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 14″ TO LESS THAN 16″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-14-HRC-1	14″	14″ hexagonal columns; gravel aggregate concrete (4970 psi); reinforcement: vertical, eight $^1/_2$″ rebars; horizontal, $^5/_{16}$″ helical winding on 2″ pitch; cover: $^1/_2$″.	90 tons	2 hrs			7	1–3	2

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Withstood 2-hour fire test.
2. Withstood hose stream test.
3. Withstood reload after 48 hours.

TABLE 2.1.10
HEXAGONAL REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION—16″ TO LESS THAN 18″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE- BMS-92	BMS-92	POST-BMS-92		
C-16-HRC-1	16″	16″ hexagonal columns; gravel concrete (6320 psi); reinforcement: vertical, eight $^5/_8$″ rebars; horizontal, $^5/_{16}$″ helical winding on $^3/_4$″ pitch; cover: $^1/_2$″.	140 tons	1 hr 55 min			7	1	$1^3/_4$
C-16-HRC-2	16″	16″ hexagonal columns; gravel aggregate concrete (5580 psi); reinforcement: vertical, eight $^5/_8$″ rebars; horizontal, $^5/_{16}$″ helical winding on $1^3/_4$″ pitch; cover: $^1/_2$″	124 tons	2 hrs			7	2	2

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Failure mode—collapse.
2. Failed on furnace removal.

TABLE 2.1.11
HEXAGONAL REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION—20″ TO LESS THAN 22″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE- BMS-92	BMS-92	POST-BMS-92		
C-20-HRC-1	20″	20″ hexagonal columns; gravel concrete (6080 psi); reinforcement: vertical, $^3/_4$″ rebars; horizontal, $^5/_{16}$″ helical winding on $1^3/_4$″ pitch; cover: $^1/_2$″.	211 tons	2 hrs			7	1	2
C-20-HRC-2	20″	20″ hexagonal columns; gravel concrete (5080 psi); reinforcement: vertical, $^3/_4$″ rebars; horizontal, $^5/_{16}$″ wire on $1^3/_4$″ pitch; cover: $^1/_2$″.	184 tons	2 hrs 15 min			7	2–4	$2^1/_4$

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Column collapsed on furnace removal.
2. Passed $2^1/_4$-hour fire test.
3. Passed hose stream test.
4. Withstood reload after 48 hours.

TABLE 2.2
ROUND CAST IRON COLUMNS

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-7-CI-1	7″ O.D.	Column: 0.6″ minimum metal thickness; unprotected.	—	30 min		1			$^1/_2$
C-7-CI-2	7″ O.D.	Column: 0.6″ minimum metal thickness concrete filled, outside unprotected.	—	45 min		1			$^3/_4$
C-11-CI-3	11″ O.D.	Column: 0.6″ minimum metal thickness; protection: $1^1/_2$″ Portland cement plaster on high ribbed metal lath, $^1/_2$″ broken air space.	—	3 hrs		1			3
C-11-CI-4	11″ O.D.	Column: 0.6″ minimum metal thickness; protection: 2″ concrete other than siliceous aggregate.	—	2 hrs 30 min		1			$2^1/_2$
C-12-CI-5	12.5″ O.D.	Column: 7″ O.D., 0.6″ minimum metal thickness; protection: 2″ porous hollow tile, $^3/_4$″ mortar between tile and column, outside wire ties.	—	3 hrs		1			3
C-7-CI-6	7.6″ O.D.	Column: 7″ I.D., $^3/_{10}$″ minimum metal thickness; concrete filled; unprotected.	—	30 min		1			$^1/_2$
C-8-CI-7	8.6″ O.D.	Column: 8″ I.D., $^3/_{10}$″ minimum metal thickness; concrete filled reinforced with four $3^1/_2$″ × $^3/_8$″ angles, in fill; unprotected outside.	—	1 hr		1			1

For SI: 1 inch = 25.4 mm.

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FIGURE 2.3
STEEL COLUMNS—GYPSUM ENCASEMENTS

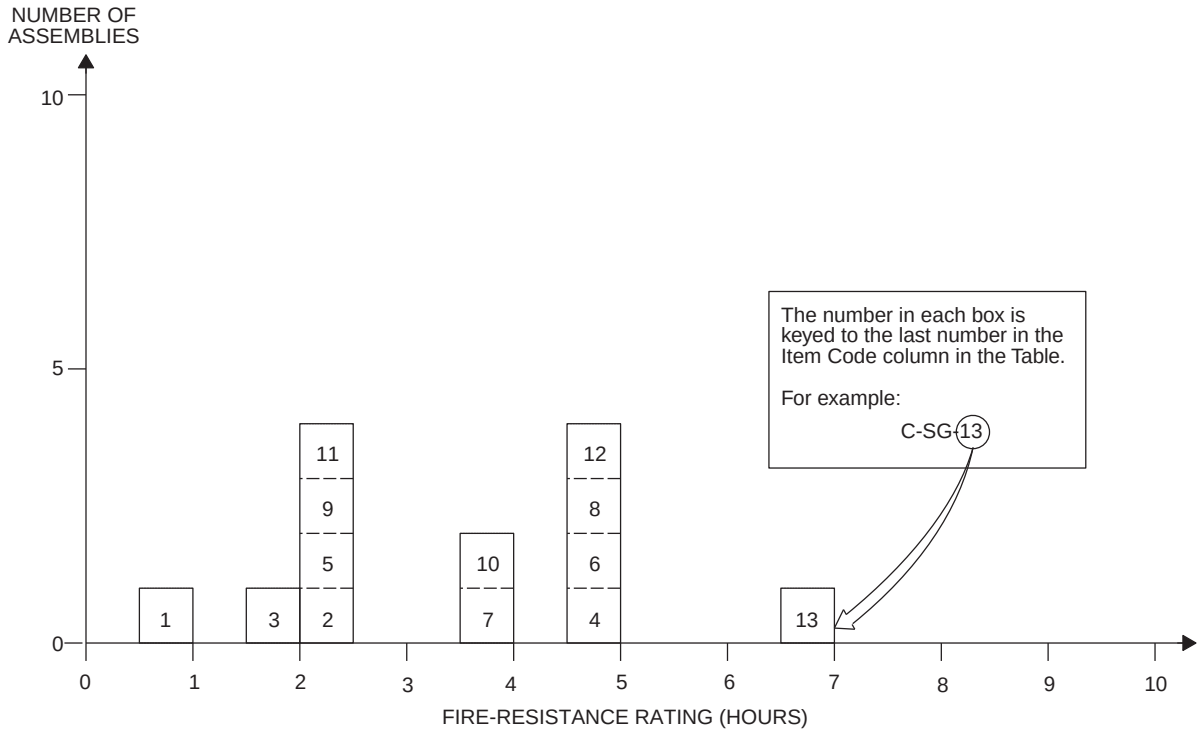

TABLE 2.3
STEEL COLUMNS—GYPSUM ENCASEMENTS

ITEM CODE	MINIMUM AREA OF SOLID MATERIAL	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-SG-1	—	Steel protected with $^3/_4$″ 1:3 sanded gypsum or 1″ 1:2$^1/_2$ Portland cement plaster on wire or lath; one layer.	—	1 hr		1			1
C-SG-2	—	Same as C-SG-1; two layers.	—	2 hrs 30 min		1			2$^1/_2$
C-SG-3	130 in.^{2}	2″ solid blocks with wire mesh in horizontal joints; 1″ mortar on flange; reentrant space filled with block and mortar.	—	2 hrs		1			2
C-SG-4	150 in.^{2}	Same as C-SG-3 with $^1/_2$″ sanded gypsum plaster.	—	5 hrs		1			5
C-SG-5	130 in.^{2}	2″ solid blocks with wire mesh in horizontal joints; 1″ mortar on flange; reentrant space filled with gypsum concrete.	—	2 hrs 30 min		1			2$^1/_2$
C-SG-6	150 in.^{2}	Same as C-SG-5 with $^1/_2$″ sanded gypsum plaster.	—	5 hrs		1			5
C-SG-7	300 in.^{2}	4″ solid blocks with wire mesh in horizontal joints; 1″ mortar on flange; reentrant space filled with block and mortar.	—	4 hrs		1			4
C-SG-8	300 in.^{2}	Same as C-SG-7 with reentrant space filled with gypsum concrete.	—	5 hrs		1			5
C-SG-9	85 in.^{2}	2″ solid blocks with cramps at horizontal joints; mortar on flange only at horizontal joints; reentrant space not filled.	—	2 hrs 30 min		1			2$^1/_2$
C-SG-10	105 in.^{2}	Same as C-SG-9 with $^1/_2$″ sanded gypsum plaster.	—	4 hrs		1			4

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TABLE 2.3—continued
STEEL COLUMNS—GYPSUM ENCASEMENTS

ITEM CODE	MINIMUM AREA OF SOLID MATERIAL	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-SG-11	95 in.^{2}	3″ hollow blocks with cramps at horizontal joints; mortar on flange only at horizontal joints; reentrant space not filled.	—	2 hrs 30 min		1			$2^1/_2$
C-SG-12	120 in.^{2}	Same as C-SG-11 with $^1/_2$″ sanded gypsum plaster.	—	5 hrs		1			5
C-SG-13	130 in.^{2}	2″ neat fibered gypsum reentrant space filled poured solid and reinforced with 4″ × 4″ wire mesh $^1/_2$″ sanded gypsum plaster.	—	7 hrs		1			7

For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm^2.

TABLE 2.4
TIMBER COLUMNS MINIMUM DIMENSION

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-11-TC-1	11″	With unprotected steel plate cap.	—	30 min		1		1, 2	$^1/_2$
C-11-TC-2	11″	With unprotected cast iron cap and pintle.	—	45 min		1		1, 2	$^3/_4$
C-11-TC-3	11″	With concrete or protected steel or cast iron cap.	—	1 hr 15 min		1		1, 2	$1^1/_4$
C-11-TC-4	11″	With $^3/_8$″ gypsum wallboard over column and over cast iron or steel cap.	—	1 hr 15 min		1		1, 2	$1^1/_4$
C-11-TC-5	11″	With 1″ Portland cement plaster on wire lath over column and over cast iron or steel cap; $^3/_4$″ air space.	—	2 hrs		1		1, 2	2

For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm^2.

Notes:

1. Minimum area: 120 square inches.
2. Type of wood: long leaf pine or Douglas fir.

TABLE 2.5.1.1
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION LESS THAN 6″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-5-SC-1	5″	5″ × 6″ outer dimensions; 4″ × 3″ × 10 lbs “H” beam; protection: gravel concrete (4900 psi) 6″ × 4″ - 13 SWG mesh.	12 tons	1 hr 29 min			7	1	$1^1/_4$

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Failure mode—collapse.

TABLE 2.5.1.2
STEEL COLUMNS—CONCRETE ENCASEMENTS
6″ TO LESS THAN 8″ THICK

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-7-SC-1	7″	7″ × 8″ column; 4″ × 3″ × 10 lbs “H” beam; protection: brick filled concrete (6220 psi); 6″ × 4″—13 SWG mesh; 1″ below column surface.	12 tons	2 hrs 46 min			7	1	$2^3/_4$
C-7-SC-2	7″	7″ × 8″ column; 4″ × 3″ × 10 lbs “H” beam; protection: gravel concrete (5140 psi); 6″ × 4″—13 SWG mesh; 1″ below surface.	12 tons	3 hrs 1 min			7	1	3
C-7-SC-3	7″	7″ × 8″ column; 4″ × 3″ × 10 lbs “H” beam; protection: concrete (4540 psi); 6″ × 4″—13 SWG mesh; 1″ below column surface.	12 tons	3 hrs 9 min			7	1	3
C-7-SC-4	7″	7″ × 8″ column; 4″ × 3″ × 10 lbs “H” beam; protection: gravel concrete (5520 psi); 4″ × 4″—16 SWG mesh.	12 tons	2 hrs 50 min			7	1	$2^3/_4$

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Failure mode—collapse.

FIGURE 2.5.1.3
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 8″ TO LESS THAN 10″

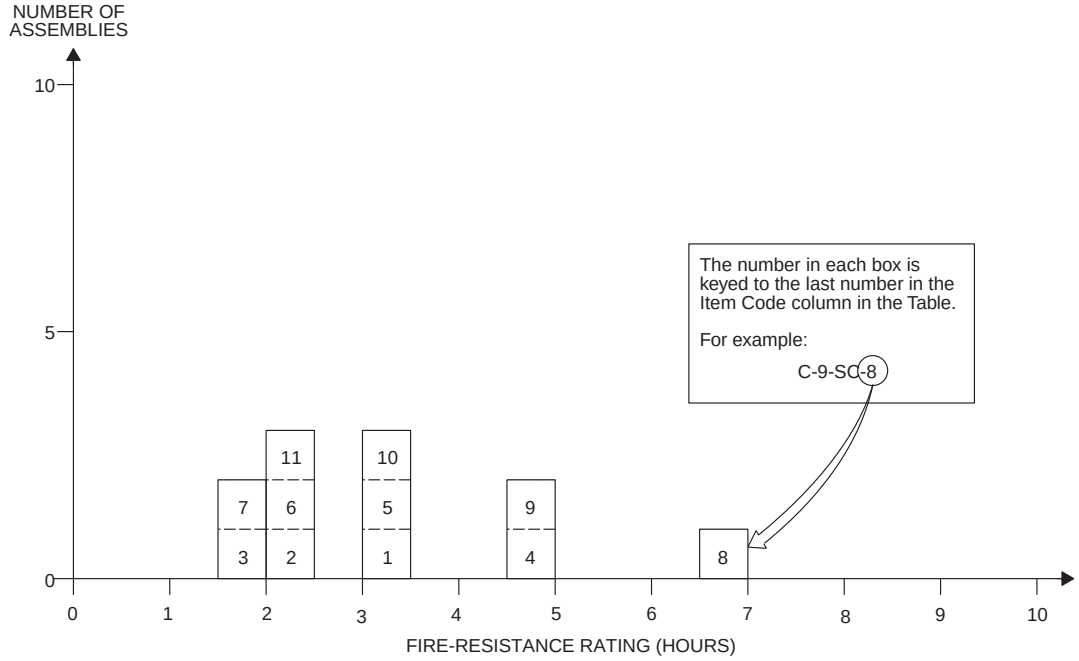

TABLE 2.5.1.3
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 8″ TO LESS THAN 10″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-8-SC-1	$8^1/_2$″	$8^1/_2$″ × 10″ column; 6″ × $4^1/_2$″ × 20 lbs “H” beam; protection: gravel concrete (5140 psi); 6″ × 4″—13 SWG mesh.	39 tons	3 hrs 8 min			7	1	3
C-8-SC-2	8″	8″ × 10″ column; 8″ × 6″ × 35 lbs “I” beam; protection: gravel concrete (4240 psi); 6″ × 4″—13 SWG mesh; $^1/_2$″ cover.	90 tons	2 hrs 1 min			7	1	2

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TABLE 2.5.1.3—continued
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 8″ TO LESS THAN 10″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-8-SC-7	8″	6″ × 6″ steel column; 2″ outside protection; Group IV.	—	1 hr 45 min		1		2	$1^3/_4$
C-8-SC-3	8″	8″ × 10″ concrete encased column; 8″ × 6″ × 35 lbs “H” beam; protection: aggregate concrete (3750 psi); 4″—16 SWG mesh, reinforcing $^1/_2$″ below column surface.	90 tons	1 hr 58 min			7	1	$1^3/_4$
C-8-SC-4	8″	6″ × 6″ steel column; 2″ outside protection; Group I.	—	5 hrs		1		2	5
C-8-SC-5	8″	6″ × 6″ steel column; 2″ outside protection; Group II.	—	3 hrs 30 min		1		2	$3^1/_2$
C-8-SC-6	8″	6″ × 6″ steel column; 2″ outside protection; Group III.	—	2 hrs 30 min		1		2	$2^1/_2$
C-9-SC-8	9″	6″ × 6″ steel column; 3″ outside protection; Group I.	—	7 hrs		1		2	7
C-9-SC-9	9″	6″ × 6″ steel column; 3″ outside protection; Group II.	—	5 hrs		1		2	5
C-9-SC-10	9″	6″ × 6″ steel column; 3″ outside protection; Group III.	—	3 hrs 30 min		1		2	$3^1/_2$
C-9-SC-11	9″	6″ × 6″ steel column; 3″ outside protection; Group IV.	—	2 hrs 30 min		1		2	$2^1/_2$

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m^2, 1 ton = 8.896 kN.

Notes:

1. Failure mode—collapse.
2. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.

   Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs/yd^2, placed not more than 1 inch from the surface of the concrete.

   Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs/yd^2, placed not more than 1 inch from the surface of the concrete.

   Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.

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FIGURE 2.5.1.4
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 10″ TO LESS THAN 12″

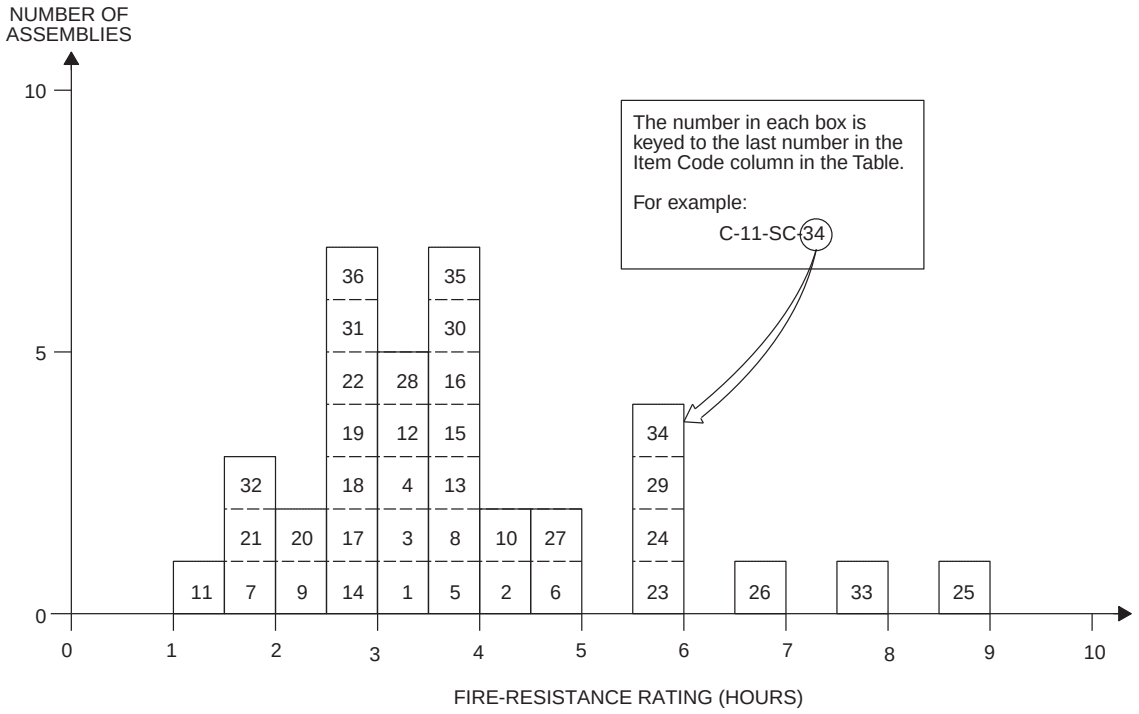

TABLE 2.5.1.4
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 10″ TO LESS THAN 12″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-10-SC-1	10″	10″ × 12″ concrete encased steel column; 8″ × 6″ × 35 lbs “H” beam; protection: gravel aggregate concrete (3640 psi); 6″ × 4″—13 SWG mesh, 1″ below column surface.	90 tons	3 hrs 7 min			7	1, 2	3
C-10-SC-2	10″	10″ × 16″ column; 8″ × 6″ × 35 lbs “H” beam; protection: clay brick concrete (3630 psi); 6″ × 4″—13 SWG mesh, 1″ below column surface.	90 tons	4 hrs 6 min			7	2	4
C-10-SC-3	10″	10″ × 12″ column; 8″ × 6″ × 35 lbs “H” beam; protection: crushed stone and sand concrete (3930 psi); 6″ × 4″—13 SWG mesh, 1″ below column surface.	90 tons	3 hrs 17 min			7	2	$3^1/_4$
C-10-SC-4	10″	10″ × 12″ column; 8″ × 6″ × 35 lbs “H” beam; protection: crushed basalt and sand concrete (4350 psi); 6″ × 4″—13 SWG mesh, 1″ below column surface.	90 tons	3 hrs 22 min			7	2	$3^1/_3$
C-10-SC-5	10″	10″ × 12″ column; 8″ × 6″ × 35 lbs “H” beam; protection: gravel aggregate concrete (5570 psi); 6″ × 4″—13 SWG mesh.	90 tons	3 hrs 39 min			7	2	$3^1/_2$
C-10-SC-6	10″	10″ × 16″ column; 8″ × 6″ × 35 lbs “I” beam; protection: gravel concrete (4950 psi); 6″ × 4″—13 SWG mesh, 1″ below column surface.	90 tons	4 hrs 32 min			7	2	$4^1/_2$
C-10-SC-7	10″	10″ × 12″ concrete encased steel column; 8″ × 6″ × 35 lbs “H” beam; protection: aggregate concrete (1370 psi); 6″ × 4″—13 SWG mesh reinforcing 1″ below column surface.	90 tons	2 hrs			7	3, 4	2

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TABLE 2.5.1.4—continued
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 10″ TO LESS THAN 12″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-10-SC-8	10″	10″ × 12″ concrete encased steel column; 8″ × 6″ × 35 lbs “H” column; protection: aggregate concrete (4000 psi); 13 SWG iron wire loosely around column at 6″ pitch about 2″ beneath column surface.	86 tons	3 hrs 36 min			7	2	3 1/2
C-10-SC-9	10″	10″ × 12″ concrete encased steel column; 8″ × 6″ × 35 lbs “H” beam; protection: aggregate concrete (3290 psi); 2″ cover minimum.	86 tons	2 hrs 8 min			7	2	2
C-10-SC-10	10″	10″ × 14″ concrete encased steel column; 8″ × 6″ × 35 lbs “H” column; protection: crushed brick filled concrete (5310 psi); 6″ × 4″—13 SWG mesh reinforcement 1″ below column surface.	90 tons	4 hrs 28 min			7	2	4 1/3
C-10-SC-11	10″	10″ × 12″ concrete encased column; 8″ × 6″ × 35 lbs “H” beam; protection: aggregate concrete (3420 psi); 6″ × 4″—13 SWG mesh reinforcement 1″ below surface.	90 tons	1 hr 2 min			7	2	1
C-10-SC-12	10″	10″ × 12″ concrete encased steel column; 8″ × 6″ × 35 lbs “H” beam; protection: aggregate concrete (4480 psi); four 3/8″ vertical bars at “H” beam edges with 3/16″ spacers at beam surface at 3′ pitch and 3/16″ binders at 10″ pitch; 2″ concrete cover.	90 tons	3 hrs 2 min			7	2	3
C-10-SC-13	10″	10″ × 12″ concrete encased steel column; 8″ × 6″ × 35 lbs “H” beam; protection: aggregate concrete (5070 psi); 6″ × 4″—13 SWG mesh reinforcing at 6″ beam sides wrapped and held by wire ties across (open) 8″ beam face; reinforcements wrapped in 6″ × 4″—13 SWG mesh throughout; 1/2″ cover to column surface.	90 tons	3 hrs 59 min			7	2	3 3/4
C-10-SC-14	10″	10″ × 12″ concrete encased steel column; 8″ × 6″ × 35 lbs “H” beam; protection: aggregate concrete (4410 psi); 6″ × 4″—13 SWG mesh reinforcement 1 1/4″ below column surface; 1/2″ limestone cement plaster with 3/8″ gypsum plaster finish.	90 tons	2 hrs 50 min			7	2	2 3/4
C-10-SC-15	10″	10″ × 12″ concrete encased steel column; 8″ × 6″ × 35 lbs “H” beam; protection: crushed clay brick filled concrete (4260 psi); 6″ × 4″—13 SWG mesh reinforcing 1″ below column surface.	90 tons	3 hrs 54 min			7	2	3 3/4
C-10-SC-16	10″	10″ × 12″ concrete encased steel column; 8″ × 6″ × 35 lbs “H” beam; protection: limestone aggregate concrete (4350 psi); 6″ × 4″—13 SWG mesh reinforcing 1″ below column surface.	90 tons	3 hrs 54 min			7	2	3 3/4
C-10-SC-17	10″	10″ × 12″ concrete encased steel column; 8″ × 6″ × 35 lbs “H” beam; protection: limestone aggregate concrete (5300 psi); 6″ × 4″—13 SWG mesh, 1″ below column surface.	90 tons	3 hrs			7	4, 5	3
C-10-SC-18	10″	10″ × 12″ concrete encased steel column; 8″ × 6″ × 35 lbs “H” beam; protection: limestone aggregate concrete (4800 psi) with 6″ × 4″—13 SWG mesh reinforcement 1″ below surface.	90 tons	3 hrs			7	4, 5	3
C-10-SC-19	10″	10″ × 14″ concrete encased steel column; 12″ × 8″ × 65 lbs “H” beam; protection: aggregate concrete (3900 psi); 4″—16 SWG mesh reinforcing 1/2″ below column surface.	118 tons	2 hrs 42 min			7	2	2

TABLE 2.5.1.4—continued
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 10″ TO LESS THAN 12″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-10-SC-20	10″	10″ × 14″ concrete encased steel column; 12″ × 8″ × 65 lbs “H” beam; protection: aggregate concrete (4930 psi); 4″—16 SWG mesh reinforcing $^{1}/_{2}$″ below column surface.	177 tons	2 hrs 8 min			7	2	2
C-10-SC-21	$10^{3}/_{8}$″	$10^{3}/_{8}$″ × $12^{3}/_{8}$″ concrete encased steel column; 8″ × 6″ × 35 lbs “H” beam; protection: aggregate concrete (835 psi) with 6″ × 4″—13 SWG mesh reinforcing $1^{3}/_{16}$″ below column surface; $^{3}/_{16}$″ gypsum plaster finish.	90 tons	2 hrs			7	3, 4	2
C-11-SC-22	11″	11″ × 13″ concrete encased steel column; 8″ × 6″ × 35 lbs “H” beam; protection: ″open texture″ brick filled concrete (890 psi) with 6″ × 4″—13 SWG mesh reinforcing $1^{1}/_{2}$″ below column surface; $^{3}/_{8}$″ lime cement plaster; $^{1}/_{8}$″ gypsum plaster finish.	90 tons	3 hrs			7	6, 7	3
C-11-SC-23	11″	11″ × 12″ column; 4″ × 3″ × 10 lbs “H” beam; gravel concrete (4550 psi); 6″ × 4″—13 SWG mesh reinforcing; 1″ below column surface.	12 tons	6 hrs			7	7, 8	6
C-11-SC-24	11″	11″ × 12″ column; 4″ × 3″ × 10 lbs “H” beam; protection: gravel aggregate concrete (3830 psi); with 4″ × 4″—16 SWG mesh, 1″ below column surface.	16 tons	5 hrs 32 min			7	2	$5^{1}/_{2}$
C-10-SC-25	10″	6″ × 6″ steel column with 4″ outside protection; Group I.	—	9 hrs		1		9	9
C-10-SC-26	10″	Description as per C-SC-25; Group II.	—	7 hrs		1		9	7
C-10-SC-27	10″	Description as per C-SC-25; Group III.	—	5 hrs		1		9	5
C-10-SC-28	10″	Description as per C-10-SC-25; Group IV.	—	3 hrs 30 min		1		9	$3^{1}/_{2}$
C-10-SC-29	10″	8″ × 8″ steel column with 2″ outside protection; Group I.	—	6 hrs		1		9	6
C-10-SC-30	10″	Description as per C-10-SC-29; Group II.	—	4 hrs		1		9	4
C-10-SC-31	10″	Description as per C-10-SC-29; Group III.	—	3 hrs		1		9	3
C-10-SC-32	10″	Description as per C-10-SC-29; Group IV.	—	2 hrs		1		9	2
C-11-SC-33	11″	8″ × 8″ steel column with 3″ outside protection; Group I.	—	8 hrs		1		9	8
C-11-SC-34	11″	Description as per C-10-SC-33; Group II.	—	6 hrs		1		9	6
C-11-SC-35	11″	Description as per C-10-SC-33; Group III.	—	4 hrs		1		9	4
C-11-SC-36	11″	Description as per C-10-SC-33; Group IV.	—	3 hrs		1		9	3

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m^2, 1 ton = 8.896 kN.

Notes:

1. Tested under total restraint load to prevent expansion—minimum load 90 tons.
2. Failure mode—collapse.
3. Passed 2-hour fire test (Grade “C,” British).
4. Passed hose stream test.
5. Column tested and passed 3-hour grade fire resistance (British).
6. Column passed 3-hour fire test.
7. Column collapsed during hose stream testing.
8. Column passed 6-hour fire test.
9. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.

   Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs/yd^2, placed not more than 1 inch from the surface of the concrete.

   Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs/yd^2, placed not more than 1 inch from the surface of the concrete.

   Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.

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FIGURE 2.5.1.5
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 12″ TO LESS THAN 14″

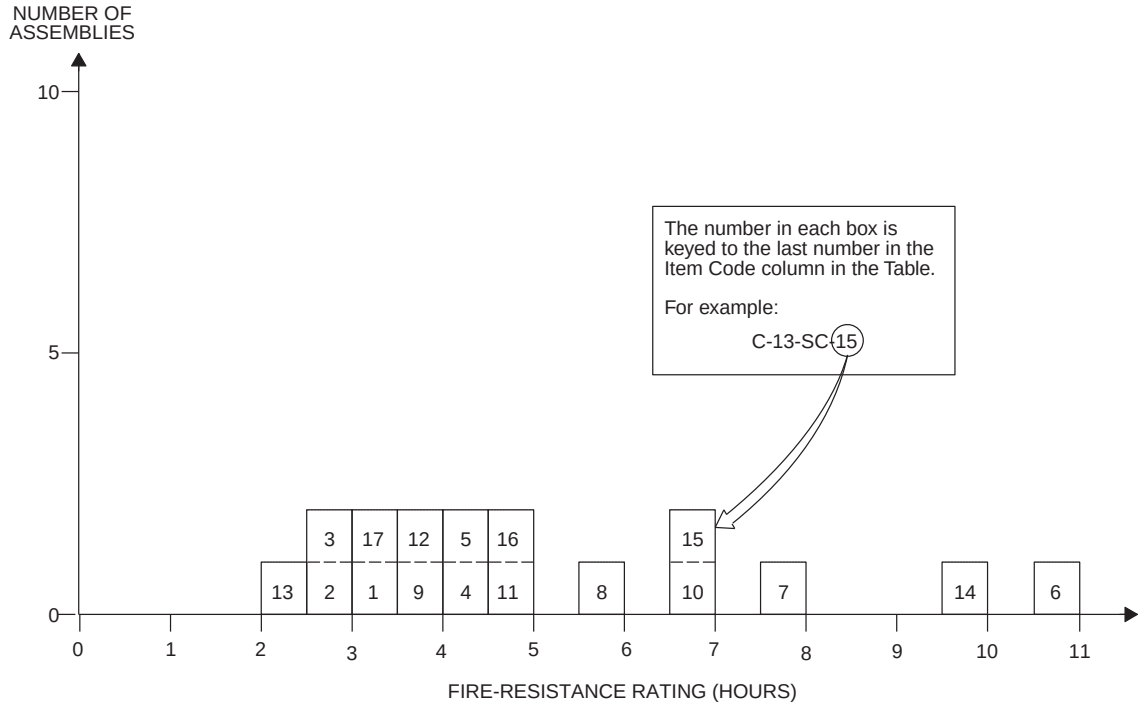

TABLE 2.5.1.5
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 12″ TO LESS THAN 14″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-SC-1	12″	12″ × 14″ concrete encased steel column; 8″ × 6″ × 35 lbs “H” beam; protection: aggregate concrete (4150 psi) with 4″—16 SWG mesh reinforcing 1″ below column surface.	120 tons	3 hrs 24 min			7	1	$3^1/_3$
C-12-SC-2	12″	12″ × 16″ concrete encased column; 8″ × 6″ × 35 lbs “H” beam; protection: aggregate concrete (4300 psi) with 4″—16 SWG mesh reinforcing 1″ below column surface.	90 tons	2 hrs 52 min			7	1	$2^3/_4$
C-12-SC-3	12″	12″ × 16″ concrete encased steel column; 12″ × 8″ × 65 lbs “H” column; protection: gravel aggregate concrete (3550 psi) with 4″—16 SWG mesh reinforcement 1″ below column surface.	177 tons	2 hrs 31 min			7	1	$2^1/_2$
C-12-SC-4	12″	12″ × 16″ concrete encased column; 12″ × 8″ × 65 lbs “H” beam; protection: aggregate concrete (3450 psi) with 4″—16 SWG mesh reinforcement 1″ below column surface.	118 tons	4 hrs 4 min			7	1	4
C-12-SC-5	$12^1/_2$″	$12^1/_2$″ × 14″ column; 6″ × $4^1/_2$″ × 20 lbs “H” beam; protection: gravel aggregate concrete (3750 psi) with 4″ × 4″—16 SWG mesh reinforcing 1″ below column surface.	52 tons	4 hrs 29 min			7	1	$4^1/_3$
C-12-SC-6	12″	8″ × 8″ steel column; 2″ outside protection; Group I.	—	11 hrs			1	2	11

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TABLE 2.5.1.5—continued
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 12″ TO LESS THAN 14″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-SC-7	12″	Description as per C-12-SC-6; Group II.	—	8 hrs		1		2	8
C-12-SC-8	12″	Description as per C-12-SC-6; Group III.	—	6 hrs		1		2	6
C-12-SC-9	12″	Description as per C-12-SC-6; Group IV.	—	4 hrs		1		2	4
C-12-SC-10	12″	10″ × 10″ steel column; 2″ outside protection; Group I.	—	7 hrs		1		2	7
C-12-SC-11	12″	Description as per C-12-SC-10; Group II.	—	5 hrs		1		2	5
C-12-SC-12	12″	Description as per C-12-SC-10; Group III.	—	4 hrs		1		2	4
C-12-SC-13	12″	Description as per C-12-SC-10; Group IV.	—	2 hrs 30 min		1		2	$2^1/_2$
C-13-SC-14	13″	10″ × 10″ steel column; 3″ outside protection; Group I.	—	10 hrs		1		2	10
C-13-SC-15	13″	Description as per C-13-SC-14; Group II.	—	7 hrs		1		2	7
C-13-SC-16	13″	Description as per C-13-SC-14; Group III.	—	5 hrs		1		2	5
C-13-SC-17	13″	Description as per C-13-SC-14; Group IV.	—	3 hrs 30 min		1		2	$3^1/_2$

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m^2, 1 ton = 8.896 kN.

Notes:

1. Failure mode—collapse.
2. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
   Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs/yd^2, placed not more than 1 inch from the surface of the concrete.
   Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs/yd^2, placed not more than 1 inch from the surface of the concrete.
   Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.

FIGURE 2.5.1.6
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 14″ TO LESS THAN 16″

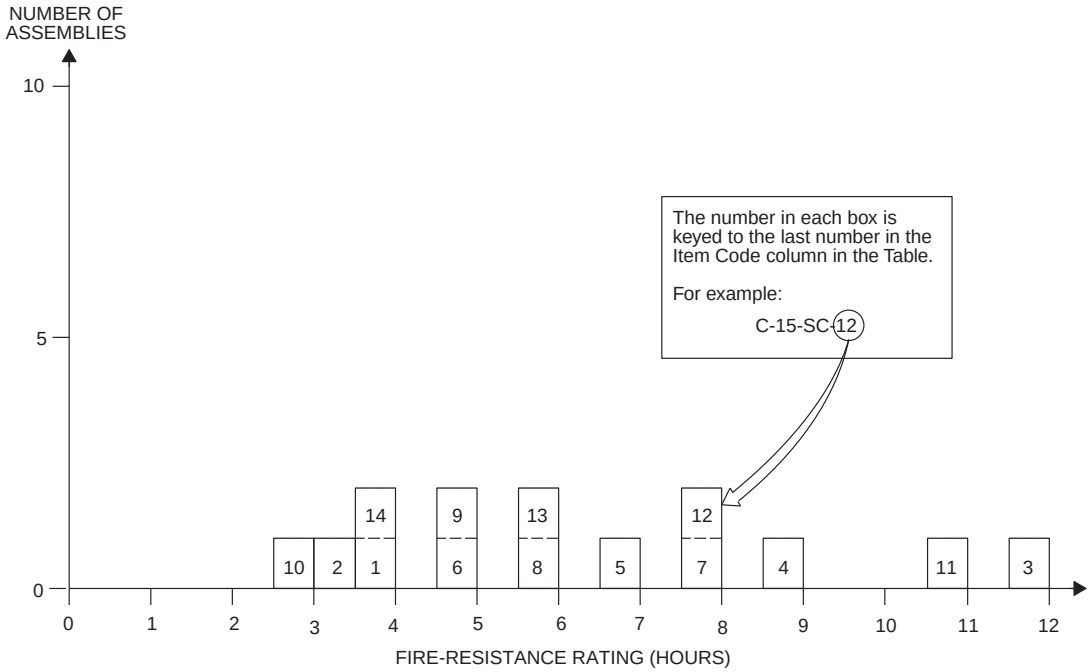

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TABLE 2.5.1.6
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 14″ TO LESS THAN 16″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-14-SC-1	14″	14″ × 16″ concrete encased steel column; 8″ × 6″ × 35 lbs “H” column; protection: aggregate concrete (4240 psi); 4″—16 SWG mesh reinforcing 1″ below column surface.	90 tons	3 hrs 40 min			7	1	3
C-14-SC-2	14″	14″ × 18″ concrete encased steel column; 12″ × 8″ × 65 lbs “H” beam; protection: gravel aggregate concrete (4000 psi) with 4″—16 SWG mesh reinforcement 1″ below column surface.	177 tons	3 hrs 20 min			7	1	3
C-14-SC-3	14″	10″ × 10″ steel column; 4″ outside protection; Group I.	—	12 hrs		1		2	12
C-14-SC-4	14″	Description as per C-14-SC-3; Group II.	—	9 hrs		1		2	9
C-14-SC-5	14″	Description as per C-14-SC-3; Group III.	—	7 hrs		1		2	7
C-14-SC-6	14″	Description as per C-14-SC-3; Group IV.	—	5 hrs		1		2	5
C-14-SC-7	14″	12″ × 12″ steel column; 2″ outside protection; Group I.	—	8 hrs		1		2	8
C-14-SC-8	14″	Description as per C-14-SC-7; Group II.	—	6 hrs		1		2	6
C-14-SC-9	14″	Description as per C-14-SC-7; Group III.	—	5 hrs		1		2	5
C-14-SC-10	14″	Description as per C-14-SC-7; Group IV	—	3 hrs		1		2	3
C-15-SC-11	15″	12″ × 12″ steel column; 3″ outside protection; Group I.	—	11 hrs		1		2	11
C-15-SC-12	15″	Description as per C-15-SC-11; Group II.	—	8 hrs		1		2	8
C-15-SC-13	15″	Description as per C-15-SC-11; Group III.	—	6 hrs		1		2	6
C-15-SC-14	15″	Description as per C-15-SC-11; Group IV.	—	4 hrs		1		2	4

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m^2, 1 ton = 8.896 kN.

Notes:

1. Collapse.
2. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
   Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs/yd^2, placed not more than 1 inch from the surface of the concrete.
   Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs/yd^2, placed not more than 1 inch from the surface of the concrete.
   Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.

TABLE 2.5.1.7
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 16″ TO LESS THAN 18″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-16-SC-1	16″	12″ × 12″ steel column; 4″ outside protection; Group I.	—	14 hrs		1		1	14
C-16-SC-2	16″	Description as per C-16-SC-1; Group II.	—	10 hrs		1		1	10
C-16-SC-3	16″	Description as per C-16-SC-1; Group III.	—	8 hrs		1		1	8
C-16-SC-4	16″	Description as per C-16-SC-1; Group IV.	—	5 hrs		1		1	5

For SI: 1 inch = 25.4 mm.

Notes:

1. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
   Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs/yd^2, placed not more than 1 inch from the surface of the concrete.
   Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs/yd^2, placed not more than 1 inch from the surface of the concrete.
   Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.

TABLE 2.5.2.1
STEEL COLUMNS—BRICK AND BLOCK ENCASEMENTS
MINIMUM DIMENSION 10″ TO LESS THAN 12″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-10-SB-1	$10^1/_2$″	$10^1/_2$″ × 13″ brick encased steel columns; 8″ × 6″ × 35 lbs “H” beam; protection. Fill of broken brick and mortar; 2″ brick on edge; joints broken in alternate courses; cement-sand grout; 13 SWG wire reinforcement in every third horizontal joint.	90 tons	3 hrs 6 min			7	1	3
C-10-SB-2	$10^1/_2$″	$10^1/_2$″ × 13″ brick encased steel columns; 8″ × 6″ × 35 lbs “H” beam; protection: 2″ brick; joints broken in alternate courses; cement-sand grout; 13 SWG iron wire reinforcement in alternate horizontal joints.	90 tons	2 hrs			7	2–4	2
C-10-SB-3	10″	10″ × 12″ block encased columns; 8″ × 6″ × 35 lbs “H” beam; protection: 2″ foamed slag concrete blocks; 13 SWG wire at each horizontal joint; mortar at each joint.	90 tons	2 hrs			7	5	2
C-10-SB-4	$10^1/_2$″	$10^1/_2$″ × 12″ block encased steel columns; 8″ × 6″ × 35 lbs “H” beam; protection: gravel aggregate concrete fill (unconsolidated) 2″ thick hollow clay tiles with mortar at edges.	86 tons	56 min			7	1	$^3/_4$
C-10-SB-5	$10^1/_2$″	$10^1/_2$″ × 12″ block encased steel columns; 8″ × 6″ × 35 lbs “H” beam; protection: 2″ hollow clay tiles with mortar at edges.	86 tons	22 min			7	1	$^1/_4$

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Failure mode—collapse.
2. Passed 2-hour fire test (Grade “C,” British).
3. Passed hose stream test.
4. Passed reload test.
5. Passed 2-hour fire exposure but collapsed immediately following hose stream test.

TABLE 2.5.2.2
STEEL COLUMNS—BRICK AND BLOCK ENCASEMENTS
MINIMUM DIMENSION 12″ TO LESS THAN 14″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-SB-1	12″	12″ × 15″ brick encased steel columns; 8″ × 6″ × 35 lbs “H” beam; protection: $2^5/_8$″ thick brick; joints broken in alternate courses; cement-sand grout; fill of broken brick and mortar.	90 tons	1 hr 49 min			7	1	$1^3/_4$

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Failure mode—collapse.

TABLE 2.5.2.3
STEEL COLUMNS—BRICK AND BLOCK ENCASEMENTS
MINIMUM DIMENSION 14″ TO LESS THAN 16″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-15-SB-1	15″	15″ × 17″ brick encased steel columns; 8″ × 6″ × 35 lbs “H” beam; protection: $4^1/_2$″ thick brick; joints broken in alternate courses; cement-sand grout; fill of broken brick and mortar.	45 tons	6 hrs			7	1	6
C-15-SB-2	15″	15″ × 17″ brick encased steel columns; 8″ × 6″ × 35 lbs “H” beam; protection. Fill of broken brick and mortar; $4^1/_2$″ brick; joints broken in alternate courses; cement-sand grout.	86 tons	6 hrs			7	2–4	6
C-15-SB-3	15″	15″ × 18″ brick encased steel columns; 8″ × 6″ × 35 lbs “H” beam; protection: $4^1/_2$″ brick work; joints alternating; cement-sand grout.	90 tons	4 hrs			7	5, 6	4
C-14-SB-4	14″	14″ × 16″ block encased steel columns; 8″ × 6″ × 35 lbs “H” beam; protection: 4″ thick foam slag concrete blocks; 13 SWG wire reinforcement in each horizontal joint; mortar in joints.	90 tons	5 hrs 52 min			7	7	$4^3/_4$

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Only a nominal load was applied to specimen.
2. Passed 6-hour fire test (Grade “A,” British).
3. Passed (6 minute) hose stream test.
4. Reload not specified.
5. Passed 4-hour fire exposure.
6. Failed by collapse between first and second minute of hose stream exposure.
7. Mode of failure—collapse.

TABLE 2.5.3.1
STEEL COLUMNS—PLASTER ENCASEMENTS
MINIMUM DIMENSION 6″ TO LESS THAN 8″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-7-SP-1	$7^1/_2$″	$7^1/_2$″ × $9^1/_2$″ plaster-protected steel columns; 8″ × 6″ × 35 lbs “H” beam; protection: 24 SWG wire metal lath; $1^1/_4$″ lime plaster.	90 tons	57 min			7	1	$^3/_4$
C-7-SP-2	$7^7/_8$″	$7^7/_8$″ × 10″ plaster-protected steel columns; 8″ × 6″ × 35 lbs “H” beam; protection: $^3/_8$″ gypsum board; 16 SWG wire helically wound at 4″ pitch; $^1/_2$″ gypsum plaster.	90 tons	1 hr 13 min			7	1	1
C-7-SP-3	$7^1/_4$″	$7^1/_4$″ × $9^3/_8$″ plaster-protected steel columns; 8″ × 6″ × 35 lbs “H” beam; protection: $^3/_8$″ gypsum board; 16 SWG wire helically wound at 4″ pitch; $^1/_4$″ gypsum plaster finish.	90 tons	1 hr 14 min			7	1	1

Notes:

1. Failure mode—collapse.

TABLE 2.5.3.2
STEEL COLUMNS—PLASTER ENCASEMENTS
MINIMUM DIMENSION 8″ TO LESS THAN 10″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-8-SP-1	8″	8″ × 10″ plaster-protected steel columns; 8″ × 6″ × 35 lbs “H” beam; protection: 24 SWG wire lath; 1″ gypsum plaster.	86 tons	1 hr 23 min			7	1	$1^1/_4$
C-8-SP-2	$8^1/_2$″	$8^1/_2$″ × $10^1/_2$″ plaster-protected steel columns; 8″ × 6″ × 35 lbs “H” beam; protection: 24 SWG metal lath wrap; $1^1/_4$″ gypsum plaster.	90 tons	1 hr 36 min			7	1	$1^1/_2$
C-9-SP-3	9″	9″ × 11″ plaster-protected steel columns; 8″ × 6″ × 35 lbs “H” beam; protection: 24 SWG metal lath wrap; $^1/_8$″ M.S. ties at 12″ pitch; wire netting $1^1/_2$″ × 22 SWG between first and second plaster coats; $1^1/_2$″ gypsum plaster.	90 tons	1 hr 33 min			7	1	$1^1/_2$
C-8-SP-4	$8^3/_4$″	$8^3/_4$″ × $10^3/_4$″ plaster-protected steel columns; 8″ × 6″ × 35 lbs “H” beam; protection: $^3/_4$″ gypsum board; wire wound spirally (#16 SWG) at $1^1/_2$″ pitch; $^1/_2$″ gypsum plaster.	90 tons	2 hrs			7	2–4	2

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Failure mode—collapse.
2. Passed 2 hour fire exposure test (Grade “C,” British).
3. Passed hose stream test.
4. Passed reload test.

TABLE 2.5.4.1
STEEL COLUMNS—MISCELLANEOUS ENCASEMENTS
MINIMUM DIMENSION 6″ TO LESS THAN 8″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-7-SM-1	$7^5/_8$″	$7^5/_8$″ × $9^1/_2$″ (asbestos plaster) protected steel columns; 8″ × 6″ × 35 lbs “H” beam; protection: 20 gage $^1/_2$″ metal lath; $^9/_{16}$″ asbestos plaster (minimum).	90 tons	1 hr 52 min			7	1	$1^3/_4$

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Failure mode—collapse.

TABLE 2.5.4.2
STEEL COLUMNS—MISCELLANEOUS ENCASEMENTS
MINIMUM DIMENSION 8″ TO LESS THAN 10″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-9-SM-1	$9^5/_8$″	$9^5/_8$″ × $11^3/_8$″ asbestos slab and cement plaster-protected columns; 8″ × 6″ × 35 lbs “H” beam; protection: 1″ asbestos slab; wire wound; $^5/_8$″ plaster.	90 tons	2 hrs			7	1, 2	2

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Passed 2-hour fire exposure test.
2. Collapsed during hose stream test.

TABLE 2.5.4.3
STEEL COLUMNS—MISCELLANEOUS ENCASEMENTS
MINIMUM DIMENSION 10″ TO LESS THAN 12″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-11-SM-1	$11^1/_2$″	$11^1/_2$″ × $13^1/_2$″ wood, wool and plaster-protected steel columns; 8″ × 6″ × 35 lbs “H” beam; protection: wood-wool-cement paste as fill and to 2″ cover over beam; $^3/_4$″ gypsum plaster finish.	90 tons	2 hrs			7	1–3	2
C-10-SM-2	10″	10″ × 12″ asbestos-protected steel columns; 8″ × 6″ × 35 lbs “H” beam; protection: sprayed on asbestos paste to 2″ cover over column.	90 tons	4 hrs			7	2–4	4

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Passed 2-hour fire exposure (Grade “C,” British).
2. Passed hose stream test.
3. Passed reload test.
4. Passed 4-hour fire exposure test.

TABLE 2.5.4.4
STEEL COLUMNS—MISCELLANEOUS ENCASEMENTS
MINIMUM DIMENSION 12″ TO LESS THAN 14″

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-SM-1	12″	12″ × $14^1/_4$″ cement- and asbestos-protected columns; 8″ × 6″ × 35 lbs “H” beam; protection: fill of asbestos packing pieces 1″ thick 1′3″ o.c.; cover of 2″ molded asbestos inner layer; 1″ molded asbestos outer layer; held in position by 16 SWG nichrome wire ties; wash of refractory cement on outer surface.	86 tons	4 hrs 43 min			7	1–3	$4^2/_3$

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Passed 4 hour fire exposure (Grade “B,” British).
2. Passed hose stream test.
3. Passed reload test.

SECTION III—FLOOR/CEILING ASSEMBLIES

FIGURE 3.1
FLOOR/CEILING ASSEMBLIES—REINFORCED CONCRETE

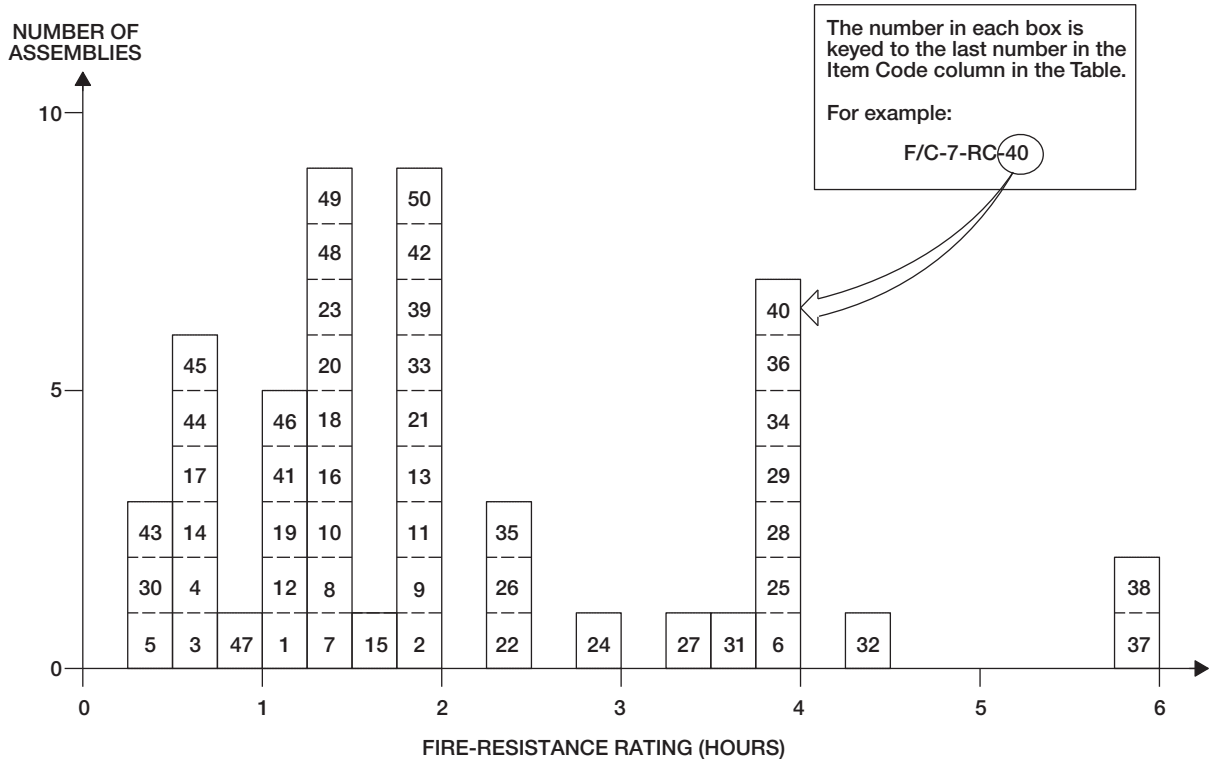

TABLE 3.1
FLOOR/CEILING ASSEMBLIES—REINFORCED CONCRETE

ITEM CODE	ASSEMBLY THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-3-RC-1	$3\frac{3}{4}$″	$3\frac{3}{4}$″ thick floor; $3\frac{1}{4}$″ (5475 psi) concrete deck; $\frac{1}{2}$″ plaster under deck; $\frac{3}{8}$″ main reinforcement bars at $5\frac{1}{2}$″ pitch with $\frac{7}{8}$″ concrete cover; $\frac{3}{8}$″ main reinforcement bars at $4\frac{1}{2}$″ pitch perpendicular with $\frac{1}{2}$″ concrete cover; 13′1″ span restrained.	195 psf	24 min			7	1, 2	$\frac{1}{3}$
F/C-3-RC-2	$3\frac{1}{4}$″	$3\frac{1}{4}$″ deep (3540 psi) concrete deck; $\frac{3}{8}$″ main reinforcement bars at $5\frac{1}{2}$″ pitch with $\frac{7}{8}$″ cover; $\frac{3}{8}$″ main reinforcement bars at $4\frac{1}{2}$″ pitch perpendicular with $\frac{1}{2}$″ cover; 13′1″ span restrained.	195 psf	2 hrs			7	1, 3, 4	2
F/C-3-RC-3	$3\frac{1}{4}$″	$3\frac{1}{4}$″ deep (4175 psi) concrete deck; $\frac{3}{8}$″ main reinforcement bars at $5\frac{1}{2}$″ pitch with $\frac{7}{8}$″ cover; $\frac{3}{8}$″ main reinforcement bars at $4\frac{1}{2}$″ pitch perpendicular with $\frac{1}{2}$″ cover; 13′1″ span restrained.	195 psf	31 min			7	1, 5	$\frac{1}{2}$
F/C-3-RC-4	$3\frac{1}{4}$″	$3\frac{1}{4}$″ deep (4355 psi) concrete deck; $\frac{3}{8}$″ main reinforcement bars at $5\frac{1}{2}$″ pitch with $\frac{7}{8}$″ cover; $\frac{3}{8}$″ main reinforcement bars at $4\frac{1}{2}$″ pitch perpendicular with $\frac{1}{2}$″ cover; 13′1″ span restrained.	195 psf	41 min			7	1, 5, 6	$\frac{1}{2}$

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TABLE 3.1—continued
FLOOR/CEILING ASSEMBLIES—REINFORCED CONCRETE

ITEM CODE	ASSEMBLY THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-3-RC-5	3 1/4″	3 1/4″ thick (3800 psi) concrete deck; 3/8″ main reinforcement bars at 5 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 4 1/2″ pitch perpendicular with 1/2″ cover; 13′1″ span restrained.	195 psf	1 hr 5 min			7	1, 5	1
F/C-4-RC-6	4 1/4″	4 1/4″ thick; 3 1/4″ (4000 psi) concrete deck; 1″ sprayed asbestos lower surface; 3/8″ main reinforcement bars at 5 7/8″ pitch with 7/8″ concrete cover; 3/8″ main reinforcement bars at 4 1/2″ pitch perpendicular with 1/2″ concrete cover; 13′1″ span restrained.	195 psf	4 hrs			7	1, 7	4
F/C-4-RC-7	4″	4″ (5025 psi) concrete deck; 1/4″ reinforcement bars at 7 1/2″ pitch with 3/4″ cover; 3/8″ main reinforcement bars at 3 3/4″ pitch perpendicular with 1/2″ cover; 13′1″ span restrained.	140 psf	1 hr 16 min			7	1, 2	1 1/4
F/C-4-RC-8	4″	4″ thick (4905 psi) deck; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 3/4″ pitch perpendicular with 1/2″ cover; 13′1″ span restrained.	100 psf	1 hr 23 min			7	1, 2	1 1/3
F/C-4-RC-9	4″	4″ deep (4370 psi); 1/4″ reinforcement bars at 6″ pitch with 3/4″ cover; 1/4″ main reinforcement bars at 4″ pitch perpendicular with 1/2″ cover; 13′1″ span restrained.	150 psf	2 hrs			7	1, 3	2
F/C-4-RC-10	4″	4″ thick (5140 psi) deck; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 3/4″ pitch perpendicular with 1/2″ cover; 13′1″ span restrained.	140 psf	1 hr 16 min			7	1, 5	1 1/4
F/C-4-RC-11	4″	4″ thick (4000 psi) concrete deck; 3″ × 1 1/2″ × 4 lbs R.S.J.; 2′6″ C.R.S.; flush with top surface; 4″ × 6″ x 13 SWG mesh reinforcement 1″ from bottom of slab; 6′6″ span restrained.	150 psf	2 hrs			7	1, 3	2
F/C-4-RC-12	4″	4″ deep (2380 psi) concrete deck; 3″ × 1 1/2″ × 4 lbs R.S.J.; 2′6″ C.R.S.; flush with top surface; 4″ × 6″ x 13 SWG mesh reinforcement 1″ from bottom surface; 6′6″ span restrained.	150 psf	1 hr 3 min			7	1, 2	1
F/C-4-RC-13	4 1/2″	4 1/2″ thick (5200 psi) deck; 1/4″ reinforcement bars at 7 1/4″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 3/4″ pitch perpendicular with 1/2″ cover; 13′1″ span restrained.	140 psf	2 hrs			7	1, 3	2
F/C-4-RC-14	4 1/2″	4 1/2″ deep (2525 psi) concrete deck; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 3/8″ pitch perpendicular with 1/2″ cover; 13′1″ span restrained.	150 psf	42 min			7	1, 5	2/3
F/C-4-RC-15	4 1/2″	4 1/2″ deep (4830 psi) concrete deck; 1 1/2″ × No. 15 gage wire mesh; 3/8″ reinforcement bars at 15″ pitch with 1″ cover; 1/2″ main reinforcement bars at 6″ pitch perpendicular with 1/2″ cover; 12′ span simply supported.	75 psf	1 hr 32 min			7	1, 8	1 1/2
F/C-4-RC-16	4 1/2″	4 1/2″ deep (4595 psi) concrete deck; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 1/2″ pitch perpendicular with 1/2″ cover; 12′ span simply supported.	75 psf	1 hr 20 min			7	1, 8	1 1/3

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TABLE 3.1—continued
FLOOR/CEILING ASSEMBLIES—REINFORCED CONCRETE

ITEM CODE	ASSEMBLY THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-4-RC-17	4 1/2″	4 1/2″ deep (3625 psi) concrete deck; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 1/2″ pitch perpendicular with 1/2″ cover; 12′ span simply supported.	75 psf	35 min			7	1, 8	1/2
F/C-4-RC-18	4 1/2″	4 1/2″ deep (4410 psi) concrete deck; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 1/2″ pitch perpendicular with 1/2″ cover; 12′ span simply supported.	85 psf	1 hr 27 min			7	1, 8	1 1/3
F/C-4-RC-19	4 1/2″	4 1/2″ deep (4850 psi) deck; 3/8″ reinforcement bars at 15″ pitch with 1″ cover; 1/2″ main reinforcement bars at 6″ pitch perpendicular with 1/2″ cover; 12′ span simply supported.	75 psf	2 hrs 15 min			7	1, 9	2 1/4
F/C-4-RC-20	4 1/2″	4 1/2″ deep (3610 psi) deck; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 1/2″ pitch perpendicular with 1/2″ cover; 12′ span simply supported.	75 psf	1 hr 22 min			7	1, 8	1 1/3
F/C-5-RC-21	5″	5″ deep; 4 1/2″ (5830 psi) concrete deck; 1/2″ plaster finish bottom of slab; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 1/2″ pitch perpendicular with 1/2″ cover; 12′ span simply supported.	69 psf	2 hrs			7	1, 3	2
F/C-5-RC-22	5″	4 1/2″ (5290 psi) concrete deck; 1/2″ plaster finish bottom of slab; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 1/2″ pitch perpendicular with 1/2″ cover; 12′ span simply supported.	No load	2 hrs 28 min			7	1, 10, 11	2 1/4
F/C-5-RC-23	5″	5″ (3020 psi) concrete deck; 3″ × 1 1/2″ × 4 lbs R.S.J.; 2′ C.R.S. with 1″ cover on bottom and top flanges; 8′ span restrained.	172 psf	1 hr 24 min			7	1, 2, 12	1 1/4
F/C-5-RC-24	5 1/2″	5″ (5180 psi) concrete deck; 1/2″ retarded plaster underneath slab; 1/4″ reinforcement bars at 7 1/2″ pitch with 1 3/8″ cover; 3/8″ main reinforcement bars at 3 1/2″ pitch perpendicular with 1″ cover; 12′ span simply supported.	60 psf	2 hrs 48 min			7	1, 10	2 3/4
F/C-6-RC-25	6″	6″ deep (4800 psi) concrete deck; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 1/2″ pitch perpendicular with 7/8″ cover; 13′1″ span restrained.	195 psf	4 hrs			7	1, 7	4
F/C-6-RC-26	6″	6″ (4650 psi) concrete deck; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ main reinforcement bars at 3 1/2″ pitch perpendicular with 1/2″ cover; 13′1″ span restrained.	195 psf	2 hrs 23 min			7	1, 2	2 1/4
F/C-6-RC-27	6″	6″ deep (6050 psi) concrete deck; 1/4″ reinforcement bars at 7 1/2″ pitch with 7/8″ cover; 3/8″ reinforcement bars at 3 1/2″ pitch perpendicular with 1/2″ cover; 13′1″ span restrained.	195 psf	3 hrs 30 min			7	1, 10	3 1/2
F/C-6-RC-28	6″	6″ deep (5180 psi) concrete deck; 1/4″ reinforcement bars at 8″ pitch with 3/4″ cover; 1/4″ reinforcement bars at 5 1/2″ pitch perpendicular with 1/2″ cover; 13′1″ span restrained.	150 psf	4 hrs			7	1, 7	4

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TABLE 3.1—continued
FLOOR/CEILING ASSEMBLIES—REINFORCED CONCRETE

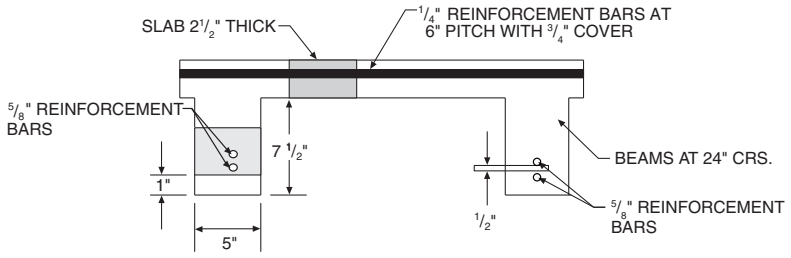
ITEM CODE	ASSEMBLY THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-6-RC-29	6″	6″ thick (4180 psi) concrete deck; 4″ × 3″ × 10 lbs R.S.J.; 2′6″ C.R.S. with 1″ cover on both top and bottom flanges; 13′1″ span restrained.	160 psf	3 hrs 48 min			7	1, 10	$3^3/_4$
F/C-6-RC-30	6″	6″ thick (3720 psi) concrete deck; 4″ × 3″ × 10 lbs R.S.J.; 2′6″ C.R.S. with 1″ cover on both top and bottom flanges; 12′ span simply supported.	115 psf	29 min			7	1, 5, 13	$^1/_4$
F/C-6-RC-31	6″	6″ deep (3450 psi) concrete deck; 4″ × $1^3/_4$″ × 5 lbs R.S.J.; 2′6″ C.R.S. with 1″ cover on both top and bottom flanges; 12′ span simply supported.	25 psf	3 hrs 35 min			7	1, 2	$3^1/_2$
F/C-6-RC-32	6″	6″ deep (4460 psi) concrete deck; 4″ × $1^3/_4$″ × 5 lbs R.S.J.; 2′ C.R.S. with 1″ cover on both top and bottom flanges; 12′ span simply supported.	60 psf	4 hrs 30 min			7	1, 10	$4^1/_2$
F/C-6-RC-33	6″	6″ deep (4360 psi) concrete deck; 4″ × $1^3/_4$″ × 5 lbs R.S.J.; 2′ C.R.S. with 1″ cover on both top and bottom flanges; 13′1″ span restrained.	60 psf	2 hrs			7	1, 3	2
F/C-6-RC-34	$6^1/_4$″	$6^1/_4$″ thick; $4^3/_4$″ (5120 psi) concrete core; 1″ T&G board flooring; $^1/_2$″ plaster undercoat; 4″ × 3″ × 10 lbs R.S.J.; 3′ C.R.S. flush with top surface concrete; 12′ span simply supported; 2″ × 1′3″ clinker concrete insert.	100 psf	4 hrs			7	1, 7	4
F/C-6-RC-35	$6^1/_4$″	$4^3/_4$″ (3600 psi) concrete core; 1″ T&G board flooring; $^1/_2$″ plaster undercoat; 4″ × 3″ × 10 lbs R.S.J.; 3′ C.R.S. flush with top surface concrete; 12′ span simply supported; 2″ × 1′3″ clinker concrete insert.	100 psf	2 hrs 30 min			7	1, 5	$2^1/_2$
F/C-6-RC-36	$6^1/_4$″	$4^3/_4$″ (2800 psi) concrete core; 1″ T&G board flooring; $^1/_2$″ plaster undercoat; 4″ × 3″ × 10 lbs R.S.J.; 3′ C.R.S. flush with top surface concrete; 12″ span simply supported; 2″ × 1′3″ clinker concrete insert.	80 psf	4 hrs			7	1, 7	4
F/C-7-RC-37	7″	(3640 psi) concrete deck; $^1/_4$″ reinforcement bars at 6″ pitch with $1^1/_2$″ cover; $^1/_4$″ reinforcement bars at 5″ pitch perpendicular with $1^1/_2$″ cover; 13′1″ span restrained.	169 psf	6 hrs			7	1, 14	6
F/C-7-RC-38	7″	(4060 psi) concrete deck; 4″ × 3″ × 10 lbs R.S.J.; 2′6″ C.R.S. with $1^1/_2$″ cover on both top and bottom flanges; 4″ × 6″ × 13 SWG mesh reinforcement $1^1/_2$″ from bottom of slab; 13′1″ span restrained.	175 psf	6 hrs			7	1, 14	6
F/C-7-RC-39	$7^1/_4$″	$5^3/_4$″ (4010 psi) concrete core; 1″ T&G board flooring; $^1/_2$″ plaster undercoat; 4″ × 3″ × 10 lbs R.S.J.; 2′6″ C.R.S. 1″ down from top surface of concrete; 12′ simply supported span; 2″ × 1′3″ clinker concrete insert.	95 psf	2 hrs			7	1, 3	2
F/C-7-RC-40	$7^1/_4$″	$5^3/_4$″ (3220 psi) concrete core; 1″ T&G board flooring; $^1/_2$″ plaster undercoat; 4″ × 3″ × 10 lbs R.S.J.; 2′6″ C.R.S. 1″ down from top surface of concrete; 12′ simply supported span; 2″ × 1′3″ clinker concrete insert.	95 psf	4 hrs			7	1, 7	4

TABLE 3.1—continued
FLOOR/CEILING ASSEMBLIES—REINFORCED CONCRETE

ITEM CODE	ASSEMBLY THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-10-RC-41	10″ ($2^1/_4$″ slab)	Ribbed floor, see Note 15 for details; slab $2^1/_2$″ deep (3020 psi); $^1/_4$″ reinforcement bars at 6″ pitch with $^3/_4$″ cover; beams $7^1/_2$″ deep × 5″ wide; 24″ C.R.S.; $^5/_8$″ reinforcement bars two rows $^1/_2$″ vertically apart with 1″ cover; 13′1″ span restricted.	195 psf	1 hr 4 min			7	1, 2, 15	1
F/C-5-RC-42	$5^1/_2$″	Composite ribbed concrete slab assembly; see Note 17 for details.	See Note 16	2 hrs			43	16, 17	2
F/C-3-RC-43	3″	2500 psi concrete; $^5/_8$″ cover; fully restrained at test.	See Note 16	30 min			43	16	$^1/_2$
F/C-3-RC-44	3″	2000 psi concrete; $^5/_8$″ cover; free or partial restraint at test.	See Note 16	45 min			43	16	$^3/_4$
F/C-4-RC-45	4″	2500 psi concrete; $^5/_8$″ cover; fully restrained at test.	See Note 16	40 min			43	16	$^2/_3$
F/C-4-RC-46	4″	2000 psi concrete; $^3/_4$″ cover; free or partial restraint at test.	See Note 16	1 hr 15 min			43	16	$1^1/_4$
F/C-5-RC-47	5″	2500 psi concrete; $^3/_4$″ cover; fully restrained at test.	See Note 16	1 hr			43	16	1
F/C-5-RC-48	5″	2000 psi concrete; $^3/_4$″ cover; free or partial restraint at test.	See Note 16	1 hr 30 min			43	16	$1^1/_2$
F/C-6-RC-49	6″	2500 psi concrete; 1″ cover; fully restrained at test.	See Note 16	1 hr 30 min			43	16	$1^1/_2$
F/C-6-RC-50	6″	2000 psi concrete; 1″ cover; free or partial restraint at test.	See Note 16	2 hrs			43	16	2

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square foot = 47.9 N/m^2.

Notes:

1. British test.
2. Failure mode—local back face temperature rise.
3. Tested for Grade “C” (2-hour) fire resistance
4. Collapse imminent following hose stream.
5. Failure mode—flame thru.
6. Void formed with explosive force and report.
7. Achieved Grade “B” (4-hour) fire resistance (British).
8. Failure mode—collapse.
9. Test was run to 2 hours, but specimen was partially supported by the furnace at $1^1/_4$ hours.
10. Failure mode—average back face temperature.
11. Recommended endurance for non-load-bearing performance only.
12. Floor maintained load-bearing ability to 2 hours at which point test was terminated.
13. Test was run to 3 hours at which time failure mode 2 (above) was reached in spite of crack formation at 29 minutes.
14. Tested for Grade “A” (6-hour) fire resistance.
15. 

16. Load unspecified.
17. Total assembly thickness $5^1/_2$ inches. Three-inch thick blocks of molded excelsior bonded with Portland cement used as inserts with $2^1/_2$-inch cover (concrete) above blocks and $^3/_4$-inch gypsum plaster below. Nine-inch-wide ribs containing reinforcing steel of unspecified size interrupted 20-inch-wide segments of slab composite (i.e., plaster, excelsior blocks, concrete cover).

FIGURE 3.2
FLOOR/CEILING ASSEMBLIES—STEEL STRUCTURAL ELEMENTS

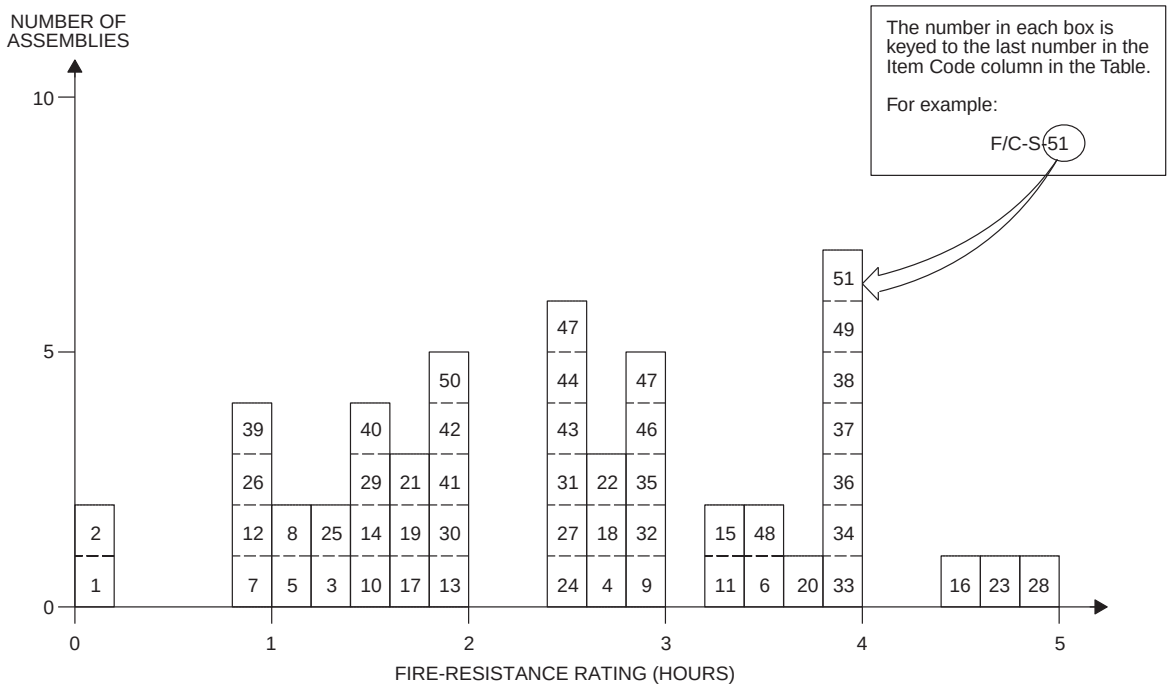


TABLE 3.2
FLOOR/CEILING ASSEMBLIES—STEEL STRUCTURAL ELEMENTS

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-S-1	0″	10′ × 13′6″; S.J. 103, 24″ o.c.; deck: 2″ concrete; membrane: none.	145 psf	7 min			3	1, 2, 3, 8	0
F/C-S-2	0″	10′ × 13′6″; S.J. 103, 24″ o.c.; deck: 2″ concrete; membrane: none	145 psf	7 min			3	1, 2, 3, 8	0
F/C-S-3	$^1/_2$″	10′ × 13′ 6″; S.J. 103, 24″ o.c.; deck: 2″ concrete, 1:2:4; membrane: furring 12″ o.c.; clips A, B, G; no extra reinforcement; $^1/_2$″ plaster, 1.5:2.5.	145 psf	1 hr 15 min			3	2, 3, 8	$1^1/_4$
F/C-S-4	$^1/_2$″	10′ × 13′ 6″; S.J. 103, 24″ o.c.; deck: 2″ concrete, 1:2:4; membrane: furring 16″ o.c.; clips D, E, F, G; diagonal wire reinforcement; $^1/_2$″ plaster, 1.5:2.5.	145 psf	2 hrs 46 min			3	3, 8	$2^3/_4$
F/C-S-5	$^1/_2$″	10′ × 13′6″; S.J. 103, 24″ o.c.; deck: 2″ concrete, 1:2:4; membrane: furring 16″ o.c.; clips A, B, G; no extra reinforcement; $^1/_2$″ plaster, 1.5:2.5.	145 psf	1 hr 4 min			3	2, 3, 8	1
F/C-S-6	$^1/_2$″	10′ × 13′6″; S.J. 103, 24″ o.c.; deck: 2″ concrete, 1:2:4; membrane: furring 16″ o.c.; clips D, E, F, G; hexagonal mesh reinforcement; $^1/_2$″ plaster.	145 psf	3 hrs 28 min			3	2, 4, 8	$2^1/_3$
F/C-S-7	$^1/_2$″	10′ × 13′6″; S.J. 103, 24″ o.c.; deck: 4 lbs rib lath; 6″ × 6″ 10 × 10 gage reinforcement; 2″ deck gravel concrete; membrane: furring 16″ o.c.; clips C, E; reinforcement: none; $^1/_2$″ plaster, 1.5:2.5 mill mix.	N/A	55 min			3	5, 8	$^3/_4$

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TABLE 3.2—continued
FLOOR/CEILING ASSEMBLIES—STEEL STRUCTURAL ELEMENTS

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-S-8	1/2″	Spec. 9′ × 4′4″; S.J. 103 bar joists, 18″ o.c.; deck: 4 lbs rib lath base; 6″ × 6″ 10 × 10 gage reinforcement; 2″ deck 1:2:4 gravel concrete; membrane: furring, 3/4″ C.R.S., 16″ o.c.; clips C, E; reinforcement: none; 1/2″ plaster, 1.5:2.5 mill mix.	300 psf	1 hr 10 min			3	2, 3, 8	1
F/C-S-9	5/8″	10′ × 13′6″; S.J. 103, 24″ o.c.; deck: 2″ concrete, 1:2:4; membrane: furring 12″ o.c.; clips A, B, G; Extra “A” clips reinforcement; 5/8″ plaster, 1.5:2, 1.5:3.	145 psf	3 hrs			3	6, 8	3
F/C-S-10	5/8″	18′ × 13′6″; joists, S.J. 103, 24″ o.c.; deck: 4 lbs rib lath; 6″ × 6″ 10 × 10 gage reinforcement; 2″ deck, 1:2:3.5 gravel concrete; membrane: furring, spacing 16″ o.c.; clips C, E; reinforcement: none; 5/8″ plaster, 1.5:2.5 mill mix.	145 psf	1 hr 25 min			3	2, 3, 8	1 1/3
F/C-S-11	5/8″	10′ × 13′6″; S.J. 103, 24″ o.c.; deck: 2″ concrete, 1:2:4; membrane: furring 12″ o.c.; clips D, E, F, G; diagonal wire reinforcement; 5/8″ plaster, 1.5:2; 0.5:3.	145 psf	3 hrs 15 min			3	2, 4, 8	3 1/4
F/C-S-12	5/8″	10′ × 13′6″; joists, S.J. 103, 24″ o.c.; deck: 3.4 lbs rib lath; 6″ × 6″ 10 × 10 gage reinforcement; 2″ deck, 1:2:4 gravel concrete; membrane: furring 16″ o.c.; clips D, E, F, G; reinforcement: none; 5/8″ plaster, 1.5:2.5.	145 psf	1 hr			3	7, 8	1
F/C-S-13	3/4″	Spec. 9′ × 4′4″; S.J. 103, 18″ o.c.; deck: 4 lbs rib lath; 6″ × 6″ 10 × 10 gage reinforcement; 2″ deck, 1:2:4 gravel concrete; membrane: furring, 3/4″ C.R.S., 16″ o.c.; clips C, E; reinforcement: none; 3/4″ plaster, 1.5:2.5 mill mix.	300 psf	1 hr 56 min			3	3, 8	1 3/4
F/C-S-14	7/8″	Floor finish: 1″ concrete; plate cont. weld; 4″ 7.7 lbs “I” beams; ceiling: 1/4″ rods 12″ o.c.; 7/8″ gypsum sand plaster.	105 psf	1 hr 35 min			6	2, 4, 9, 10	1 1/2
F/C-S-15	1″	Floor finish: 1 1/2″ L.W. concrete; 1/2″ limestone cement; plate cont. weld; 5″, 10 lbs “I” beams; ceiling: 1/4″ rods, 12″ o.c. tack welded to beams; metal lath; 1″ P. C. plaster.	165 psf	3 hrs 20 min			6	4, 9, 11	3 1/3
F/C-S-16	1″	10′ × 13′6″; S.J. 103, 24″ o.c.; deck: 2″ concrete, 1:2:4; membrane: furring 12″ o.c.; clips D, E, F, G; hexagonal mesh reinforcement; 1″ thick plaster, 1.5:2; 1.5:3.	145 psf	4 hrs 26 min			3	2, 4, 8	4 1/3
F/C-S-17	1″	10′ × 13′6″; S.J. 103, 24″ o.c.; deck: 3.4 lbs rib lath; 6″ × 6″ 10 × 10 gage reinforcement; 2″ deck 1:2:4 gravel concrete; membrane: furring 16″ o.c.; clips D, E, F, G; 1″ plaster.	145 psf	1 hr 42 min			3	2, 4, 8	1 2/3
F/C-S-18	1 1/8″	10′ × 13′6″; S.J. 103, 24″ o.c.; deck: 2″ concrete 1:2:4; membrane: furring 12″ o.c.; clips C, E, F, G; diagonal wire reinforcement; 1 1/8″ plaster.	145 psf	2 hrs 44 min			3	2, 4, 8	2 2/3
F/C-S-19	1 1/8″	10′ × 13′6″; S.J. 103, 24″ o.c.; deck: 1 1/2″ gypsum concrete over; 1/2″ gypsum board base; membrane: furring 12″ o.c.; clips D, E, F, G; 1 1/8″ plaster, 1.5:2; 1.5:3.	145 psf	1 hr 40 min			3	2, 3, 8	1 2/3
F/C-S-20	1 1/8″	2 1/2″ cinder concrete; 1/2″ topping; plate 6″ welds 12″ o.c.; 5″ 18.9 lbs “H” center; 5″ 10 lbs “I” ends; 1″ channels 18″ o.c.; 1 1/8″ gypsum sand plaster.	150 psf	3 hrs 43 min			6	2, 4, 9, 11	3 2/3
F/C-S-21	1 1/4″	10′ × 13′6″; S.J. 103, 24″ o.c.; deck: 1 1/2″ gypsum concrete over; 1/2″ gypsum board base; membrane: furring 12″ o.c.; clips D, E, F, G; 1 1/4″ plaster, 1.5:2; 1.5:3.	145 psf	1 hr 48 min			3	2, 3, 8	1 2/3

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TABLE 3.2—continued
FLOOR/CEILING ASSEMBLIES—STEEL STRUCTURAL ELEMENTS

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-S-22	1 1/4″	Floor finish: 1 1/2″ limestone concrete; 1/2″ sand cement topping; plate to beams 3 1/2″; 12″ o.c. welded; 5″ 10 lbs "I" beams; 1″ channels 18″ o.c.; 1 1/4″ wood fiber gypsum sand plaster on metal lath.	292 psf	2 hrs 45 min			6	2, 4, 9, 10	2 3/4
F/C-S-23	1 1/2″	2 1/2″ L.W. (gas exp.) concrete; deck: 1/2″ topping; plate 6 1/4″ welds 12″ o.c.; beams: 5″ 18.9 lbs "H" center; 5″ 10 lbs "I" ends; membrane: 1″ channels 18″ o.c.; 1 1/2″ gypsum sand plaster.	150 psf	4 hrs 42 min			6	2, 4, 9	4 2/3
F/C-S-24	1 1/2″	Floor finish: 1 1/2″ limestone concrete; 1/2″ cement topping; plate 3 1/2″ 12″ o.c. welded; 5″ 10 lbs "I" beams; ceiling: 1″ channels 18″ o.c.; 1 1/2″ gypsum plaster.	292 psf	2 hrs 34 min			6	2, 4, 9, 10	2 1/2
F/C-S-25	1 1/2″	Floor finish: 1 1/2″ gravel concrete on exp. metal; plate cont. weld; 4″ 7.7 lbs "I" beams; ceiling: 1/4″ rods 12″ o.c. welded to beams; 1 1/2″ fiber gypsum sand plaster.	70 psf	1 hr 24 min			6	2, 4, 9, 10	1 1/3
F/C-S-26	2 1/2″	Floor finish: bare plate; 6 1/4″ welding, 12″ o.c.; 5″ 18.9 lbs "H" girders (inner); 5″ 10 lbs "I" girders (two outer); 1″ channels 18″ o.c.; 2″ reinforced gypsum tile; 1/2″ gypsum sand plaster.	122 psf	1 hr			6	7, 9, 11	1
F/C-S-27	2 1/2″	Floor finish: 2″ gravel concrete; plate to beams 3 1/2″ welded 12″ o.c.; 4″ 7.7 lbs "I" beams; 2″ gypsum ceiling tiles; 1/2″ 1:3 gypsum sand plaster.	105 psf	2 hrs 31 min			6	2, 4, 9, 10	2 1/2
F/C-S-28	2 1/2″	Floor finish: 1 1/2″ gravel concrete; 1/2″ gypsum asphalt; plate continuous weld; 4″ 7.7 lbs "I" beams; 12″ 31.8 lbs "I" beams, girder at 5′ from one end; 1″ channels 18″ o.c.; 2″ reinforcement gypsum tile; 1/2″ 1:3 gypsum sand plaster.	200 psf	4 hrs 55 min			6	2, 4, 9, 11	4 2/3
F/C-S-29	3/4″	Floor: 2″ reinforced concrete or 2″ precast reinforced gypsum tile; ceiling: 3/4″ Portland cement-sand plaster 1:2 for scratch coat and 1:3 for brown coat with 15 lbs hydrated lime and 3 lbs of short asbestos fiber bag per cement or 3/4″ sanded gypsum plaster 1:2 for scratch coat and 1:3 for brown coat.	See Note 12	1 hr 30 min		1		12–14	1 1/2
F/C-S-30	3/4″	Floor: 2 1/4″ reinforced concrete or 2″ reinforced gypsum tile, the latter with 1/4″ mortar finish; ceiling: 3/4″ sanded gypsum plaster, 1:2 for scratch coat and 1:3 for brown coat.	See Note 12	2 hrs		1		12–14	2
F/C-S-31	3/4″	Floor: 2 1/2″ reinforced concrete or 2″ reinforced gypsum tile, the latter with 1/4″ mortar finish; ceiling: 1″ neat gypsum plaster or 3/4″ gypsum-vermiculite plaster, ratio of gypsum to fine vermiculite 2:1 to 3:1.	See Note 12	2 hrs 30 min		1		12–14	2 1/2
F/C-S-32	3/4″	Floor: 2 1/2″ reinforced concrete or 2″ reinforced gypsum tile, the latter with 1/2″ mortar finish; ceiling: 1″ neat gypsum plaster or 3/4″ gypsum-vermiculite plaster, ratio of gypsum to fine vermiculite 2:1 to 3:1.	See Note 12	3 hrs		1		12–14	3
F/C-S-33	1″	Floor: 2 1/2″ reinforced concrete or 2″ reinforced gypsum slabs, the latter with 1/2″ mortar finish; ceiling: 1″ gypsum-vermiculite plaster applied on metal lath in a ratio of 2:1 to 3:1 gypsum to vermiculite by weight.	See Note 12	4 hrs		1		12–14	4

TABLE 3.2—continued
FLOOR/CEILING ASSEMBLIES—STEEL STRUCTURAL ELEMENTS

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-S-34	$2^1/_2$″	Floor: 2″ reinforced concrete or 2″ precast reinforced Portland cement concrete or gypsum slabs, precast slabs to be finished with $^1/_4$″ mortar top coat; ceiling: 2″ precast reinforced gypsum tile, anchored into beams with metal ties or clips and covered with $^1/_2$″ 1:3 sanded gypsum plaster.	See Note 12	4 hrs		1		12–14	4
F/C-S-35	1″	Floor: 1:3:6 Portland cement, sand and gravel concrete applied directly to the top of steel units and $1^1/_2$″ thick at top of cells, plus $^1/_2$″ 1:$2^1/_2$″ cement-sand finish, total thickness at top of cells, 2″; ceiling: 1″ neat gypsum plaster, back of lath 2″ or more from underside of cellular steel.	See Note 15	3 hrs		1		15–18	3
F/C-S-36	1″	Floor: same as F/C-S-35; ceiling: 1″ gypsum-vermiculite plaster (ratio of gypsum to vermiculite 2:1 to 3:1), the back of lath 2″ or more from under-side of cellular steel.	See Note 15	4 hrs		1		15–18	4
F/C-S-37	1″	Floor: same as F/C-S-35; ceiling: 1″ neat gypsum plaster; back of lath 9″ or more from underside of cellular steel.	See Note 15	4 hrs		1		15–18	4
F/C-S-38	1″	Floor: same as F/C-S-35; ceiling: 1″ gypsum-vermiculite plaster (ratio of gypsum to vermiculite 2:1 to 3:1), the back of lath being 9″ or more from underside of cellular steel.	See Note 15	5 hrs		1		15–18	5
F/C-S-39	$^3/_4$″	Floor: asbestos paper 14 lbs/100 ft^2 cemented to steel deck with waterproof linoleum cement, wood screeds and $^7/_8$″ wood floor; ceiling: $^3/_4$″ sanded gypsum plaster 1:2 for scratch coat and 1:3 for brown coat.	See Note 19	1 hr		1		19–22	1
F/C-S-40	$^3/_4$″	Floor: $1^1/_2$″ 1:2:4 Portland cement concrete; ceiling: $^3/_4$″ sanded gypsum plaster 1:2 for scratch coat and 1:3 for brown coat.	See Note 19	1 hr 30 min		1		19–22	$1^1/_2$
F/C-S-41	$^3/_4$″	Floor: 2″ 1:2:4 Portland cement concrete; ceiling: $^3/_4$″ sanded gypsum plaster, 1:2 for scratch coat and 1:3 for brown coat.	See Note 19	2 hrs		1		19–22	2
F/C-S-42	1″	Floor: 2″ 1:2:4 Portland cement concrete; ceiling: 1″ Portland cement-sand plaster with 10 lbs of hydrated lime for each bag of cement, 1:2 for scratch coat and 1:$2^1/_2$ for brown coat.	See Note 19	2 hrs		1		19–22	2
F/C-S-43	$1^1/_2$″	Floor: 2″ 1:2:4 Portland cement concrete; ceiling: $1^1/_2$″ 1:2 sanded gypsum plaster on ribbed metal lath.	See Note 19	2 hrs 30 min		1		19–22	$2^1/_2$
F/C-S-44	$1^1/_8$″	Floor: 2″ 1:2:4 Portland cement concrete; ceiling: $1^1/_8$″ 1:1 sanded gypsum plaster.	See Note 19	2 hrs 30 min		1		19–22	$2^1/_2$
F/C-S-45	1″	Floor: $2^1/_2$″ 1:2:4 Portland cement concrete; ceiling: 1″ 1:2 sanded gypsum plaster.	See Note 19	2 hrs 30 min		1		19–22	$2^1/_2$
F/C-S-46	$^3/_4$″	Floor: $2^1/_2$″ 1:2:4 Portland cement concrete; ceiling: 1″ neat gypsum plaster or $^3/_4$″ gypsum-vermiculite plaster, ratio of gypsum to vermiculite 2:1 to 3:1.	See Note 19	3 hrs		1		19–22	3
F/C-S-47	$1^1/_8$″	Floor: $2^1/_2$″ 1:2:4 Portland cement, sand and cinder concrete plus $^1/_2$″ 1:$2^1/_2$ cement-sand finish; total thickness 3″; ceiling: $1^1/_8$″ 1:1 sanded gypsum plaster.	See Note 19	3 hrs		1		19–22	3
F/C-S-48	$1^1/_8$″	Floor: $2^1/_2$″ gas expanded Portland cement-sand concrete plus $^1/_2$″ 1:2.5 cement-sand finish; total thickness 3″; ceiling: $1^1/_8$″ 1:1 sanded gypsum plaster.	See Note 19	3 hrs 30 min		1		19–22	$3^1/_2$

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TABLE 3.2—continued
FLOOR/CEILING ASSEMBLIES—STEEL STRUCTURAL ELEMENTS

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-S-49	1″	Floor: $2^1/_2$″ 1:2:4 Portland cement concrete; ceiling: 1″ gypsum vermiculite plaster, ratio of gypsum to vermiculite 2:1 to 3:1.	See Note 19	4 hrs		1		19–22	4
F/C-S-50	$2^1/_2$″	Floor: 2″ 1:2:4 Portland cement concrete; ceiling: 2″ interlocking gypsum tile supported on upper face of lower flanges of beams, $^1/_2$″ 1:3 sanded gypsum plaster.	See Note 19	2 hrs		1		19–22	2
F/C-S-51	$2^1/_2$″	Floor: 2″ 1:2:4 Portland cement concrete; ceiling: 2″ precast metal reinforced gypsum tile, $^1/_2$″ 1:3 sanded gypsum plaster (tile clipped to channels which are clipped to lower flanges of beams).	See Note 19	4 hrs		1		12, 20–22	4

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square foot = 47.9 N/m^2.

Notes:

1. No protective membrane over structural steel.
2. Performance time indicates first endpoint reached; only several tests were continued to points where other failures occurred.
3. Load failure.
4. Thermal failure.
5. This is an estimated time to load-bearing failure. The same joist and deck specimen was used for a later test with different membrane protection.
6. Test stopped at 3 hours to reuse specimen; no endpoint reached.
7. Test stopped at 1 hour to reuse specimen; no endpoint reached.
8. All plaster used = gypsum.
9. Specimen size: 18 feet by $13^1/_2$ inches. Floor deck base material: $^1/_4$-inch by 18-foot steel plate welded to "I" beams.
10. "I" beams, 24 inches o.c.
11. "I" beams, 48 inches o.c.
12. Apply to open-web joists, pressed steel joists or rolled steel beams, which are not stressed beyond 18,000 lbs/in.^{2} in flexure for open-web pressed or light rolled joists, and 20,000 lbs/in.^{2} for American standard or heavier rolled beams.
13. Ratio of weight of Portland cement to fine and coarse aggregates combined for floor slabs shall not be less than $1:6^1/_2$.
14. Plaster for ceiling shall be applied on metal lath which shall be tied to supports to give the equivalent of single No. 18 gage steel wires 5 inches o.c.
15. Load: maximum fiber stress in steel not to exceed 16,000 psi.
16. Prefabricated units 2 feet wide with length equal to the span, composed of two pieces of No. 18 gage formed steel welded together to give four longitudinal cells.
17. Depth not less than 3 inches and distance between cells not less than 2 inches.
18. Ceiling: metal lath tied to furring channels secured to runner channels hung from cellular steel.
19. Load: rolled steel supporting beams and steel plate base shall not be stressed beyond 20,000 psi in flexure. Formed steel (with wide upper flange) construction shall not be stressed beyond 16,000 psi.
20. Some type of expanded metal or woven wire shall be embedded to prevent cracking in concrete flooring.
21. Ceiling plaster shall be metal lath wired to rods or channels which are clipped or welded to steel construction. Lath shall be no smaller than 18 gage steel wire and not more than 7 inches o.c.
22. The securing rods or channels shall be at least as effective as single $^3/_{16}$-inch rods with 1-inch of their length bent over the lower flanges of beams with the rods or channels tied to this clip with 14 gage iron wire.

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FIGURE 3.3
FLOOR/CEILING ASSEMBLIES—WOOD JOIST

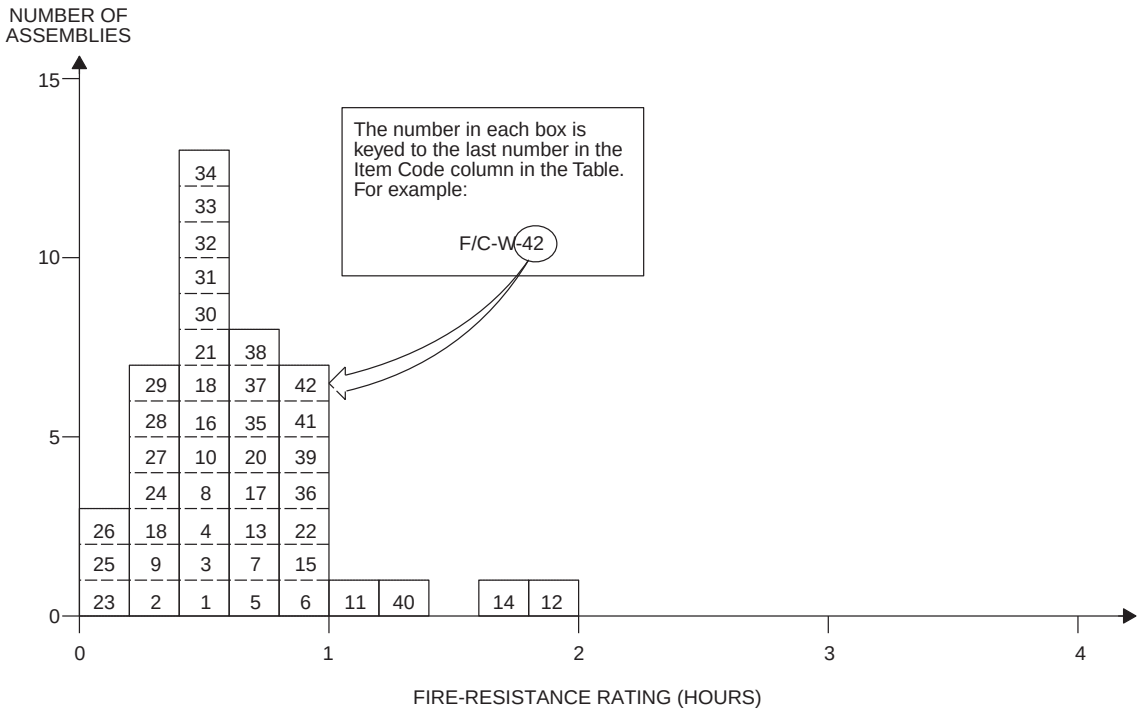

TABLE 3.3
FLOOR/CEILING ASSEMBLIES—WOOD JOIST

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-W-1	3/8″	12′ clear span, 2″ × 9″ wood joists 18″ o.c.; deck: 1″ T&G; filler: 3″ of ashes on 1/2″ boards nailed to joist sides 2″ from bottom; 2″ air space; membrane: 3/8″ gypsum board.	60 psf	36 min			7	1, 2	1/2
F/C-W-2	1/2″	12′ clear span, 2″ × 7″ joists 15″ o.c.; deck: 1″ nominal lumber; membrane: 1/2″ fiberboard.	60 psf	22 min			7	1–3	1/4
F/C-W-3	1/2″	12′ clear span, 2″ × 7″ wood joists 16″ o.c.; 2″ × 1 1/2″ bridging at center; deck: 1″ T&G; membrane: 1/2″ fiberboard; 2 coats “distemper” paint.	30 psf	28 min			7	1, 3, 15	1/3
F/C-W-4	3/16″	12′ clear span, 2″ × 7″ wood joists 16″ o.c.; 2″ × 1 1/2″ bridging at center span; deck: 1″ nominal lumber; membrane: 1/2″ fiberboard under 3/16″ gypsum plaster.	30 psf	32 min			7	1, 2	1/2
F/C-W-5	5/8″	As per F/C-W-4, except membrane is 5/8″ lime plaster.	70 psf	48 min			7	1, 2	3/4
F/C-W-6	5/8″	As per F/C-W-5, except membrane is 5/8″ gypsum plaster on 22 gage 3/8″ metal lath.	70 psf	49 min			7	1, 2	3/4
F/C-W-7	1/2″	As per F/C-W-6, except membrane is 1/2″ fiberboard under 1/2″ gypsum plaster.	60 psf	43 min			7	1–3	2/3
F/C-W-8	1/2″	As per F/C-W-7, except membrane is 1/2″ gypsum board.	60 psf	33 min			7	1–3	1/2
F/C-W-9	9/16″	12′ clear span, 2″ × 7″ wood joists 15″ o.c.; 2″ × 1 1/2″ bridging at center; deck: 1″ nominal lumber; membrane: 3/8″ gypsum board; 3/16″ gypsum plaster.	60 psf	24 min			7	1–3	1/3

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TABLE 3.3—continued
FLOOR/CEILING ASSEMBLIES—WOOD JOIST

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-W-10	5/8″	As per F/C-W-9, except membrane is 5/8″ gypsum plaster on wood lath.	60 psf	27 min			7	1–3	1/3
F/C-W-11	7/8″	12′ clear span, 2″ × 9″ wood joists 15″ o.c.; 2″ × 1 1/2″ bridging at center span; deck: 1″ T&G; membrane: original ceiling joists have 3/8″ plaster on wood lath; 4″ metal hangers attached below joists creating 15″ chases filled with mineral wool and closed with 7/8″ plaster (gypsum) on 3/8″ S.W.M. metal lath to form new ceiling surface.	75 psf	1 hr 10 min			7	1, 2	1
F/C-W-12	7/8″	12′ clear span, 2″ × 9″ wood joists 15″ o.c.; 2″ × 1 1/2″ bridging at center; deck: 1″ T&G; membrane: 3″ mineral wool below joists; 3″ hangers to channel below joists; 7/8″ gypsum plaster on metal lath attached to channels.	75 psf	2 hrs			7	1, 4	2
F/C-W-13	7/8″	12′ clear span, 2″ × 9″ wood joists 16″ o.c.; 2″ × 1 1/2″ bridging at center span; deck: 1″ T&G on 1″ bottoms on 3/4″ glass wool strips on 3/4″ gypsum board nailed to joists; membrane: 3/4″ glass wool strips on joists; 3/8″ perforated gypsum lath; 1/2″ gypsum plaster.	60 psf	41 min			7	1, 3	2/3
F/C-W-14	7/8″	12′ clear span, 2″ × 9″ wood joists 15″ o.c.; deck: 1″ T&G; membrane: 3″ foam concrete in cavity on 1/2″ boards nailed to joists; wood lath nailed to 1″ × 1 1/4″ straps 14 o.c. across joists; 7/8″ gypsum plaster.	60 psf	1 hr 40 min			7	1, 5	1 2/3
F/C-W-15	7/8″	12′ clear span, 2″ × 9″ wood joists 18″ o.c.; deck: 1″ T&G; membrane: 2″ foam concrete on 1/2″ boards nailed to joist sides 2″ from joist bottom; 2″ air space; 1″ × 1 1/4″ wood straps 14″ o.c. across joists; 7/8″ lime plaster on wood lath.	60 psf	53 min			7	1, 2	3/4
F/C-W-16	7/8″	12′ clear span, 2″ × 9″ wood joists deck: 1″ T&G; membrane: 3″ ashes on 1/2″ boards nailed to joist sides 2″ from joist bottom; 2″ air space; 1″ × 1 1/4″ wood straps 14″ o.c.; 7/8″ gypsum plaster on wood lath.	60 psf	28 min			7	1, 2	1/3
F/C-W-17	7/8″	As per F/C-W-16 but with lime plaster mix.	60 psf	41 min			7	1, 2	2/3
F/C-W-18	7/8″	12′ clear span, 2″ × 9″ wood joists 18″ o.c.; 2″ × 1 1/2″ bridging at center; deck: 1″ T&G; membrane: 7/8″ gypsum plaster on wood lath.	60 psf	36 min			7	1, 2	1/2
F/C-W-19	7/8″	As per F/C-W-18, except with lime plaster membrane and deck is 1″ nominal boards (plain edge).	60 psf	19 min			7	1, 2	1/4
F/C-W-20	7/8″	As per F/C-W-19, except deck is 1″ T&G boards.	60 psf	43 min			7	1, 2	2/3
F/C-W-21	1″	12′ clear span, 2″ × 9″ wood joists 16″ o.c.; 2″ × 1 1/2″ center bridging; deck: 1″ T&G; membrane: 3/8″ gypsum base board; 5/8″ gypsum plaster.	70 psf	29 min			7	1, 2	1/3
F/C-W-22	1 1/8″	12′ clear span, 2″ × 9″ wood joists 16″ o.c.; 2″ × 2″ wood bridging at center; deck: 1″ T&G; membrane: hangers, channel with 3/8″ gypsum baseboard affixed under 3/4″ gypsum plaster.	60 psf	1 hr			7	1–3	1
F/C-W-23	3/8″	Deck: 1″ nominal lumber; joists 2″ × 7″, 15″ o.c.; membrane: 3/8″ plasterboard with plaster skim coat.	60 psf	11 1/2 min			12	2, 6	1/6
F/C-W-24	1/2″	Deck: 1″ T&G lumber; joists 2″ × 9″, 16″ o.c.; membrane: 1/2″ plasterboard.	60 psf	18 min			12	2, 7	1/4
F/C-W-25	1/2″	Deck: 1″ T&G lumber; joists 2″ × 7″, 16″ o.c.; membrane: 1/2″ fiber insulation board.	30 psf	8 min			12	2, 8	2/15

TABLE 3.3—continued
FLOOR/CEILING ASSEMBLIES—WOOD JOIST

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-W-26	1/2″	Deck: 1″ nominal lumber; joists: 2″ × 7″, 15″ o.c.; membrane: 1/2″ fiber insulation board.	60 psf	8 min			12	2, 9	2/15
F/C-W-27	5/8″	Deck: 1″ nominal lumber; joists: 2″ × 7″, 15″ o.c.; membrane: 5/8″ gypsum plaster on wood lath.	60 psf	17 min			12	2, 10	1/4
F/C-W-28	5/8″	Deck: 1″ T&G lumber; joists: 2″ × 9″, 16″ o.c.; membrane: 1/2″ fiber insulation board; 1/2″ plaster.	60 psf	20 min			12	2, 11	1/3
F/C-W-29	No membrane	Exposed wood joists.	See Note 13	15 min		1		1, 12–14	1/4
F/C-W-30	3/8″	Gypsum wallboard: 3/8″ or 1/2″ with 1 1/2″ No. 15 gage nails with 3/16″ heads spaced 6″ o.c. with asbestos paper applied with paperhangers' paste and finished with casein paint.	See Note 13	25 min		1		1, 12–14	1/3
F/C-W-31	1/2″	Gypsum wallboard: 1/2″ with 1 3/4″ No. 12 gage nails with 1/2″ heads, 6″ o.c., and finished with casein paint.	See Note 13	25 min		1		1, 12–14	1/3
F/C-W-32	1/2″	Gypsum wallboard: 1/2″ with 1 1/2″ No. 12 gage nails with 1/2″ heads, 18″ o.c., with asbestos paper applied with paperhangers' paste and secured with 1 1/2″ No. 15 gage nails with 3/16″ heads and finished with casein paint; combined nail spacing 6″ o.c.	See Note 13	30 min		1		1, 12–14	1/2
F/C-W-33	3/8″	Gypsum wallboard: two layers 3/8″ secured with 1 1/2″ No. 15 gage nails with 3/8″ heads, 6″ o.c.	See Note 13	30 min		1		1, 12–14	1/2
F/C-W-34	1/2″	Perforated gypsum lath: 3/8″, plastered with 1 1/8″ No. 13 gage nails with 5/16″ heads, 4″ o.c.; 1/2″ sanded gypsum plaster.	See Note 13	30 min		1		1, 12–14	1/2
F/C-W-35	1/2″	Same as F/C-W-34, except with 1 1/8″ No. 13 gage nails with 3/8″ heads, 4″ o.c.	See Note 13	45 min		1		1, 12–14	3/4
F/C-W-36	1/2″	Perforated gypsum lath: 3/8″, nailed with 1 1/8″ No. 13 gage nails with 3/8″ heads, 4″ o.c.; joints covered with 3″ strips of metal lath with 1 3/4″ No. 12 gage nails with 1/2″ heads, 5″ o.c.; 1/2″ sanded gypsum plaster.	See Note 13	1 hr		1		1, 12–14	1
F/C-W-37	1/2″	Gypsum lath: 3/8″ and lower layer of 3/8″ perforated gypsum lath nailed with 1 3/4″ No. 13 gage nails with 5/16″ heads, 4″ o.c.; 1/2″ sanded gypsum plaster or 1/2″ Portland cement plaster.	See Note 13	45 min		1		1, 12–14	3/4
F/C-W-38	3/4″	Metal lath: nailed with 1 1/4″ No. 11 gage nails with 3/8″ heads or 6d common nails driven 1″ and bent over, 6″ o.c.; 3/4″ sanded gypsum plaster.	See Note 13	45 min		1		1, 12–14	3/4
F/C-W-39	3/4″	Same as F/C-W-38, except nailed with 1 1/2″ No. 11 barbed roof nails with 7/16″ heads, 6″ o.c.	See Note 13	1 hr		1		1, 12–14	1
F/C-W-40	3/4″	Same as F/C-W-38, except with lath nailed to joists with additional supports for lath 27″ o.c.; attached to alternate joists and consisting of two nails driven 1 1/4″, 2″ above bottom on opposite sides of the joists, one loop of No. 18 wire slipped over each nail, the ends twisted together below lath.	See Note 13	1 hr 15 min		1		1, 12–14	1 1/4

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TABLE 3.3—continued
FLOOR/CEILING ASSEMBLIES—WOOD JOIST

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-W-41	$^3/_4$″	Metal lath: nailed with $1^1/_2$″ No. 11 barbed roof nails with $^7/_{16}$″ heads, 6 o.c., with $^3/_4$″ Portland cement plaster for scratch coat and 1:3 for brown coat, 3 lbs of asbestos fiber and 15 lbs of hydrated lime per 94 lbs bag of cement.	See Note 13	1 hr		1		1, 12–14	1
F/C-W-42	$^3/_4$″	Metal lath: nailed with 8d No. $11^1/_2$ gage barbed box nails, $2^1/_2$″ driven, $1^1/_4$″ on slant and bent over, 6″ o.c.; $^3/_4$″ sanded gypsum plaster, 1:2 for scratch coat and 1:3 for below coat.	See Note 13	1 hr		1		1, 12–14	1

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square foot = 47.9 N/m^2.

Notes:

1. Thickness indicates thickness of first membrane protection on ceiling surface.
2. Failure mode—flame thru.
3. Failure mode—collapse.
4. No endpoint reached at termination of test.
5. Failure imminent—test terminated.
6. Joist failure—11.5 minutes; flame thru—13 minutes; collapse—24 minutes.
7. Joist failure—17 minutes; flame thru—18 minutes; collapse—33 minutes.
8. Joist failure—18 minutes; flame thru—8 minutes; collapse—30 minutes.
9. Joist failure—12 minutes; flame thru—8 minutes; collapse—22 minutes.
10. Joist failure—11 minutes; flame thru—17 minutes; collapse—27 minutes.
11. Joist failure—17 minutes; flame thru—20 minutes; collapse—43 minutes.
12. Joists: 2-inch by 10-inch southern pine or Douglas fir, No. 1 common or better. Subfloor: $^3/_4$-inch wood sheathing diaphragm of asbestos paper, and finish of tongue-and-groove wood flooring.
13. Loadings: not more than 1,000 psi maximum fiber stress in joists.
14. Perforations in gypsum lath are to be not less than $^3/_4$-inch diameter with one perforation for not more than 16/in.^{2} diameter.
15. “Distemper” is a British term for a water-based paint such as white wash or calcimine.

FIGURE 3.4
FLOOR/CEILING ASSEMBLIES—HOLLOW CLAY TILE WITH REINFORCED CONCRETE

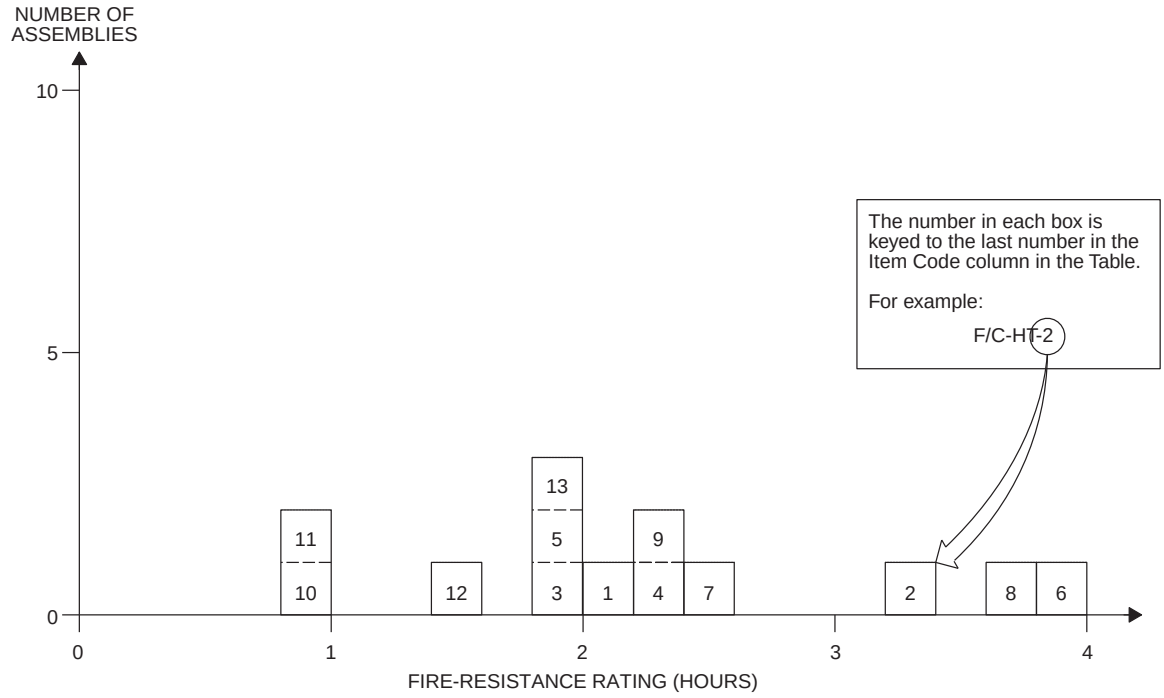

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TABLE 3.4
FLOOR/CEILING ASSEMBLIES—HOLLOW CLAY TILE WITH REINFORCED CONCRETE

ITEM CODE	ASSEMBLY THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-HT-1	6″	Cover: $1^1/_2$″ concrete (6080 psi); three-cell hollow clay tiles, 12″ × 12″ × 4″; $3^1/_4$″ concrete between tiles, including two $^1/_2$″ rebars with $^3/_4$″ concrete cover; $^1/_2$″ plaster cover, lower.	75 psf	2 hrs 7 min			7	1–3	2
F/C-HT-2	6″	Cover: $1^1/_2$″ concrete (5840 psi); three-cell, 12″ × 12″ × 4″; $3^1/_4$″ concrete between tiles, including two $^1/_2$″ rebars each with $^1/_2$″ concrete cover and $^5/_8$″ filler tiles, between hollow tiles; $^1/_2$″ plaster cover, lower.	61 psf	3 hrs 23 min			7	3, 4, 6	$3^1/_3$
F/C-HT-3	6″	Cover: $1^1/_2$″ concrete (6280 psi); three-cell hollow clay tiles, 12″ × 12″ × 4″; $3^1/_4$″ concrete between tiles, including two $^1/_2$″ rebars with $^1/_2$″ cover; $^1/_2$″ plaster cover, lower.	122 psf	2 hrs			7	1, 3, 5, 8	2
F/C-HT-4	6″	Cover: $1^1/_2$″ concrete (6280 psi); three-cell hollow clay tiles, 12″ × 12″ × 4″; $3^1/_4$″ concrete between tiles, including two $^1/_2$″ rebars with $^3/_4$″ cover; $^1/_2$″ plaster cover, lower.	115 psf	2 hrs 23 min			7	1, 3, 7	$2^1/_3$
F/C-HT-5	6″	Cover: $1^1/_2$″ concrete (6470 psi); three-cell hollow clay tiles, 12″ × 12″ × 4″; $3^1/_4$″ concrete between tiles, including two $^1/_2$″ rebars with $^1/_2$″ cover; $^1/_2$″ plaster cover, lower.	122 psf	2 hrs			7	1, 3, 5, 8	2
F/C-HT-6	8″	Floor cover: $1^1/_2$″ gravel cement (4300 psi); three-cell hollow clay tiles, 12″ × 12″ × 6″; $3^1/_2$″ space between tiles, including two $^1/_2$″ rebars with 1″ cover from concrete bottom; $^1/_2$″ plaster cover, lower.	165 psf	4 hrs			7	1, 3, 9, 10	4
F/C-HT-7	9″ (nom.)	Deck: $^7/_8$″ T&G on 2″ × $1^1/_2$″ bottoms (18″ o.c.), $1^1/_2$″ concrete cover (4600 psi); three-cell hollow clay tiles, 12″ × 12″ × 4″; 3″ concrete between tiles, including one $^3/_4$″ rebar $^3/_4$″ from tile bottom; $^3/_4$″ plaster cover.	95 psf	2 hrs 26 min			7	4, 11–13	$2^1/_3$
F/C-HT-8	9″ (nom.)	Deck: $^7/_8$″ T&G on 2″ × $1^1/_2$″ bottoms (18″ o.c.), $1^1/_2$″ concrete cover (3850 psi); three-cell hollow clay tiles, 12″ × 12″ × 4″; 3″ concrete between tiles, including one $^3/_4$″ rebar $^3/_4$″ from tile bottoms; $^1/_2$″ plaster cover.	95 psf	3 hrs 28 min			7	4, 11–13	
F/C-HT-9	9″ (nom.)	Deck: $^7/_8$″ T&G on 2″ × $1^1/_2$″ bottoms (18″ o.c.), $1^1/_2$″ concrete cover (4200 psi); three-cell hollow clay tiles, 12″ × 12″ × 4″; 3″ concrete between tiles, including one $^3/_4$″ rebar $^3/_4$″ from tile bottoms; $^1/_2$″ plaster cover.	95 psf	2 hrs 14 min			7	3, 5, 8, 11	
F/C-HT-10	$5^1/_2$″	Fire clay tile (4″ thick); $1^1/_2$″ concrete cover; for general details, see Note 15.	See Note 14	1 hr			43	15	1
F/C-HT-11	8″	Fire clay tile (6″ thick); 2″ cover.	See Note 14	1 hr			43	15	1
F/C-HT-12	$5^1/_2$″	Fire clay tile (4″ thick); $1^1/_2$″ cover; $^5/_8$″ gypsum plaster, lower.	See Note 14	1 hr 30 min			43	15	$1^1/_2$
F/C-HT-13	8″	Fire clay tile (6″ thick); 2″ cover; $^5/_8$″ gypsum plaster, lower.	See Note 14	2 hrs			43	15	$1^1/_2$

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square foot = 47.9 N/m^2.

Notes:

1. A generalized cross section of this floor type follows:

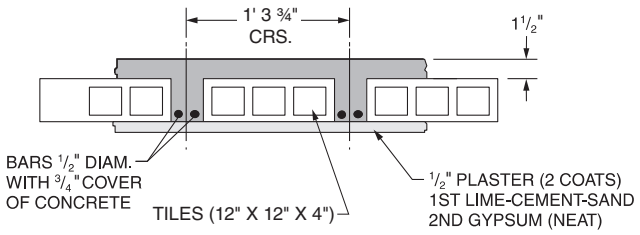

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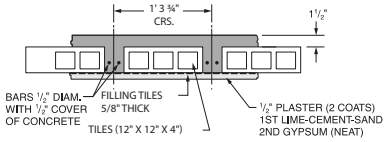
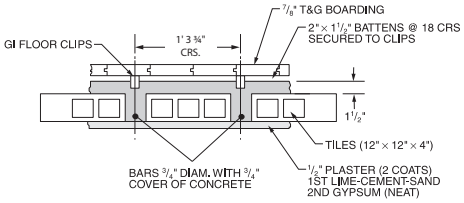
TABLE 3.4—continued
FLOOR/CEILING ASSEMBLIES—HOLLOW CLAY TILE WITH REINFORCED CONCRETE

2. Failure mode - structural.
3. Plaster: base coat—lime-cement-sand; top coat—gypsum (neat).
4. Failure mode—collapse.
5. Test stopped before any endpoints were reached.
6. A generalized cross section of this floor type follows:


1' 3 ¾" CRS.
1 1/2"
BARS 1/2" DIAM. WITH 1/2" COVER OF CONCRETE
FILLING TILES 5/8" THICK
TILES (12" X 12" X 4")
1/2" PLASTER (2 COATS)
1ST LIME-CEMENT-SAND
2ND GYPSUM (NEAT)

7. Failure mode—thermal; back face temperature rise.
8. Passed hose stream test.
9. Failed hose stream test.
10. Test stopped at 4 hours before any endpoints were reached.
11. A generalized cross section of this floor type follows:


7/8" T&G BOARDING
2" × 1 1/2" BATTENS @ 18 CRS SECURED TO CLIPS
GI FLOOR CLIPS
1' 3 ¾" CRS.
1 1/2"
TILES (12" × 12" × 4")
BARS 3/4" DIAM. WITH 3/4" COVER OF CONCRETE
1/2" PLASTER (2 COATS)
1ST LIME-CEMENT-SAND
2ND GYPSUM (NEAT)

12. Plaster: base coat—retarded hemihydrate gypsum-sand; second coat—neat gypsum.
13. Concrete in Item 7 is Portland cement-based but with crushed brick aggregates, while in Item 8, river sand and river gravels are used with the Portland cement.
14. Load—unspecified.
15. The 12-inch by 12-inch fire-clay tiles were laid end to end in rows spaced $2^1/_2$ inches or 4 inches apart. The reinforcing steel was placed between these rows and the concrete cast around them and over the tile to form the structural floor.

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SECTION IV—BEAMS

TABLE 4.1.1
REINFORCED CONCRETE BEAMS
DEPTH 10″ TO LESS THAN 12″

ITEM CODE	DEPTH	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
B-11-RC-1	11″	24″ wide × 11″ deep reinforced concrete “T” beam (3290 psi); details: see Note 5 figure.	8.8 tons	4 hrs 2 min			7	1, 2, 14	4
B-10-RC-2	10″	24″ wide × 10″ deep reinforced concrete “T” beam (4370 psi); details: see Note 6 figure.	8.8 tons	1 hr 53 min			7	1, 3	$1^{3}/_{4}$
B-10-RC-3	$10^{1}/_{2}$″	24″ wide × $10^{1}/_{2}$″ deep reinforced concrete “T” beam (4450 psi); details: see Note 7 figure.	8.8 tons	2 hrs 40 min			7	1, 3	$2^{2}/_{3}$
B-11-RC-4	11″	24″ wide × 11″ deep reinforced concrete “T” beam (2400 psi); details: see Note 8 figure.	8.8 tons	3 hrs 32 min			7	1, 3, 14	$3^{1}/_{2}$
B-11-RC-5	11″	24″ wide × 11″ deep reinforced concrete “T” beam (4250 psi); details: see Note 9 figure.	8.8 tons	3 hrs 3 min			7	1, 3, 14	3
B-11-RC-6	11″	Concrete flange: 4″ deep × 2' wide (4895 psi) concrete; concrete beam: 7″ deep × $6^{1}/_{2}$″ wide; “I” beam reinforcement; 10″ × $4^{1}/_{2}$″ × 25 lbs R.S.J.; 1″ cover on flanges; flange reinforcement: $^{3}/_{8}$″ diameter bars at 6″ pitch parallel to “T”; $^{1}/_{4}$″ diameter bars perpendicular to “T”; beam reinforcement: 4″ × 6″ No. 13 SWG wire mesh; span: 11' restrained; details: see Note 10 figure.	10 tons	6 hrs			7	1, 4	6
B-11-RC-7	11″	Concrete flange: 6″ deep × 1' $6^{1}/_{2}$″ wide (3525 psi) concrete; concrete beam: 5″ deep × 8″ wide precast concrete blocks $8^{3}/_{4}$″ long; “I” beam reinforcement; 7″ × 4″ × 16 lbs R.S.J.; 2″ cover on bottom; $1^{1}/_{2}$″ cover on top; flange reinforcement: two rows $^{1}/_{2}$″ diameter rods parallel to “T”; beam reinforcement: $^{1}/_{8}$″ wire mesh perpendicular to “T”; span: 1′3″ simply supported; details: see Note 11 figure.	3.9 tons	4 hrs			7	1, 2	4
B-11-RC-8	11″	Concrete flange: 4″ deep × 2' wide (3525 psi) concrete; concrete beam 7″ deep × $4^{1}/_{2}$″ wide (scaled from drawing); “I” beam reinforcement; 10″ × $4^{1}/_{2}$″ × 25 lbs R.S.J.; no concrete cover on bottom; flange reinforcement: $^{3}/_{8}$″ diameter bars at 6 pitch parallel to “T”; $^{1}/_{4}$″ diameter bars perpendicular to “T”; span: 11′ restricted; details: see Note 12 figure.	10 tons	4 hrs			7	1, 2	4
B-11-RC-9	$11^{1}/_{2}$″	24″ wide × $11^{1}/_{2}$″ deep reinforced concrete “T” beam (4390 psi); details: see Note 13 figure.	8.8 tons	3 hrs 24 min			7	1, 3	$3^{1}/_{3}$

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Load concentrated at mid-span.
2. Achieved 4-hour performance (Class “B,” British).
3. Failure mode—collapse.
4. Achieved 6-hour performance (Class “A,” British).

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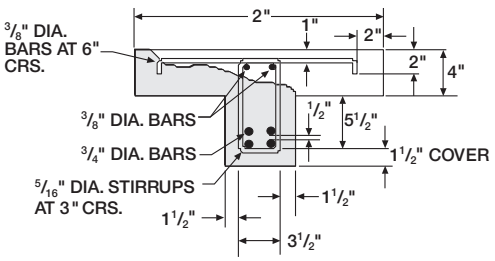
TABLE 4.1.1—continued
REINFORCED CONCRETE BEAMS
DEPTH 10″ TO LESS THAN 12″

5.



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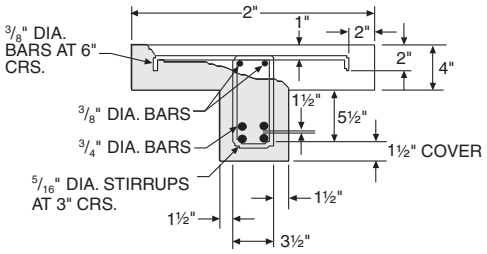

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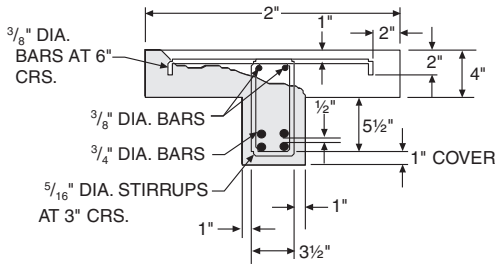

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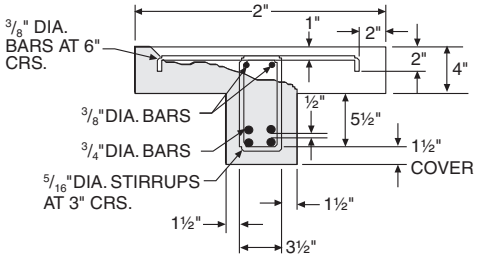

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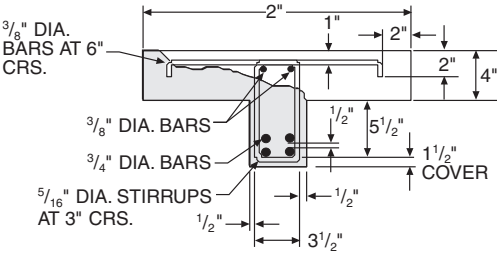

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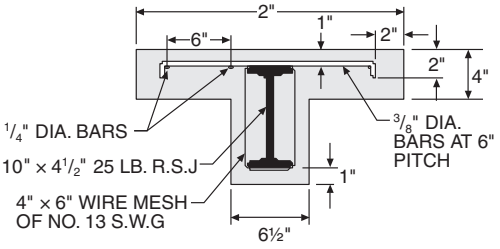

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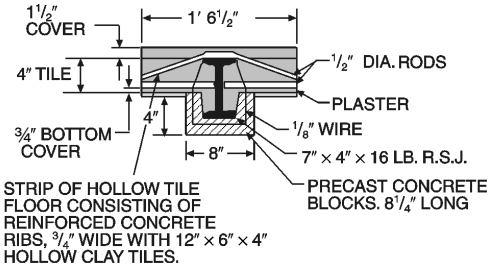
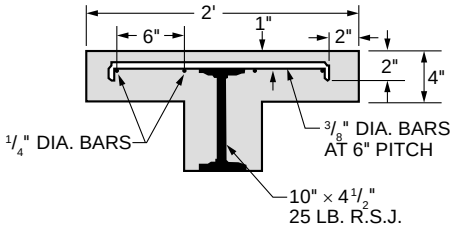

1 1/2" COVER
1′ 6 1/2″
4″ TILE
1/2″ DIA. RODS
PLASTER
4″
1/8″ WIRE
3/4″ BOTTOM COVER
8″
7″ × 4″ × 16 LB. R.S.J.
PRECAST CONCRETE BLOCKS. 8 1/4″ LONG
STRIP OF HOLLOW TILE FLOOR CONSISTING OF REINFORCED CONCRETE RIBS, 3/4″ WIDE WITH 12″ × 6″ × 4″ HOLLOW CLAY TILES.

SPAN AND END CONDITIONS:-10′-3″ (CLEAR). SIMPLY SUPPORTED.

12.



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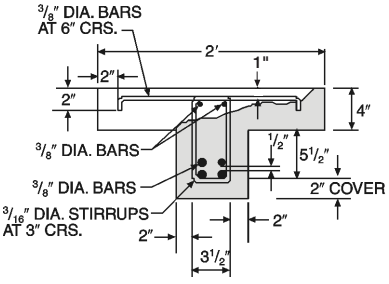

14. The different performances achieved by B-11-RC-1, B-11-RC-4 and B-11-RC-5 are attributable to differences in concrete aggregate compositions reported in the source document but unreported in this table. This demonstrates the significance of material composition in addition to other details.

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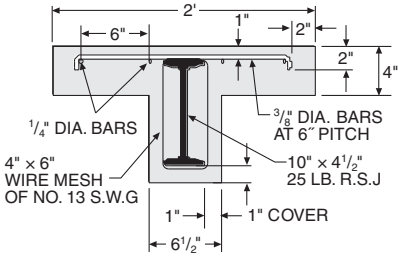
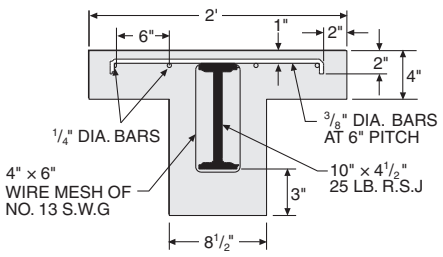
TABLE 4.1.2
REINFORCED CONCRETE BEAMS
DEPTH 12″ TO LESS THAN 14″

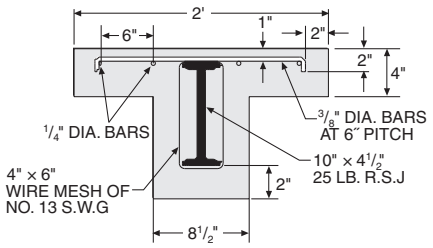
ITEM CODE	DEPTH	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
B-12-RC-1	12″	12″ × 8″ section; 4160 psi aggregate concrete; reinforcement: four $^{7}/_{8}$″ rebars at corners; 1″ below each surface; $^{1}/_{4}$″ stirrups 10″ o.c.	5.5 tons	2 hrs			7	1	2
B-12-RC-2	12″	Concrete flange: 4″ deep × 2' wide (3045 psi) concrete at 35 days; concrete beam: 8″ deep; “I” beam reinforcement: 10″ × $4^{1}/_{2}$″ × 25 lbs R.S.J.; 1″ cover on flanges; flange reinforcement: $^{3}/_{8}$″ diameter bars at 6″ pitch parallel to “T”; $^{1}/_{4}$″ diameter bars perpendicular to “T”; beam reinforcement: 4″ × 6″ No. 13 SWG wire mesh; span: 10′3″ simply supported.	10 tons	4 hrs			7	2, 3, 5	4
B-13-RC-3	13″	Concrete flange: 4″ deep × 2' wide (3825 psi) concrete at 46 days; concrete beam: 9″ deep × $8^{1}/_{2}$″ wide (scaled from drawing); “I” beam reinforcement: 10″ × $4^{1}/_{2}$″ × 25 lbs R.S.J.; 3″ cover on bottom flange; 1″ cover on top flange; flange reinforcement: $^{3}/_{8}$″ diameter bars at 6″ pitch parallel to “T”; $^{1}/_{4}$″ diameter bars perpendicular to “T”; beam reinforcement: 4″ × 6″ No. 13 SWG wire mesh; span: 11′ restrained.	10 tons	6 hrs			7	2, 3, 6, 8, 9	4
B-12-RC-4	12″	Concrete flange: 4″ deep × 2' wide (3720 psi) concrete at 42 days; concrete beam: 8″ deep × $8^{1}/_{2}$″ wide (scaled from drawing); “I” beam reinforcement: 10″ × $4^{1}/_{2}$″ × 25 lbs R.S.J.; 2″ cover bottom flange; 1″ cover top flange; flange reinforcement: $^{3}/_{8}$″ diameter bars at 6″ pitch parallel to “T”; $^{1}/_{4}$″ diameter bars perpendicular to “T”; beam reinforcement: 4″ × 6″ No. 13 SWG wire mesh; span: 11′ restrained.	10 tons	6 hrs			7	2–4, 7–9	4

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Qualified for 2-hour use. British test (Grade “C”) included hose stream and reload at 48 hours.
2. Load concentrated at mid-span.
3. British test.
4. British test—qualified for 6-hour use (Grade “A”).
5. 

6. 

7. 

8. See Table 4.1.3, Note 5.
9. Hourly rating based upon B-12-RC-2.

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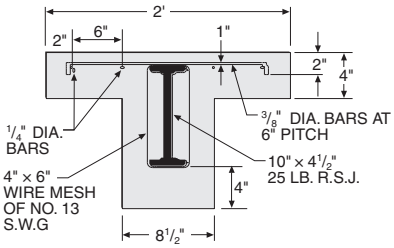
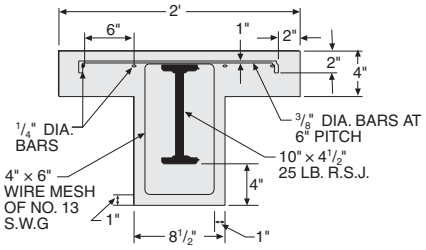
TABLE 4.1.3
REINFORCED CONCRETE BEAMS
DEPTH 14″ TO LESS THAN 16″

ITEM CODE	DEPTH	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
B-15-RC-1	15″	Concrete flange: 4″ deep × 2' wide (3290 psi) concrete; concrete beam: 10″ deep × $8^1/_2$″ wide; "I" beam reinforcement: 10″ × $4^1/_2$″ × 25 lbs R.S.J.; 4″ cover on bottom flange; 1″ cover on top flange; flange reinforcement: $^3/_8$″ diameter bars at 6″ pitch parallel to "T"; $^1/_4$″ diameter bars perpendicular to "T"; beam reinforcement: 4″ × 6″ No. 13 SWG wire mesh; span: 11′ restrained.	10 tons	6 hrs			7	1–3, 5, 6	4
B-15-RC-2	15″	Concrete flange: 4″ deep × 2' wide (4820 psi) concrete; concrete beam: 10″ deep × $8^1/_2$″ wide; "I" beam reinforcement: 10″ × $4^1/_2$″ × 25 lbs R.S.J.; 1″ cover over wire mesh on bottom flange; 1″ cover on top flange; flange reinforcement: $^3/_8$″ diameter bars at 6″ pitch parallel to "T"; $^1/_4$″ diameter bars perpendicular to "T"; beam reinforcement: 4″ × 6″ No. 13 SWG wire mesh; span: 11′ restrained.	10 tons	6 hrs			7	1, 2, 4–6	4

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Load concentrated at mid-span.
2. Achieved 6-hour fire rating (Grade "A," British).
3. 

4. 

5. Section 43.147 of the 1979 edition of the *Uniform Building Code Standards* provides:

"A restrained condition in fire tests, as used in this standard, is one in which expansion at the supports of a load-carrying element resulting from the effects of the fire is resisted by forces external to the element. An unrestrained condition is one in which the load-carrying element is free to expand and rotate at its support.

"Restraint in buildings is defined as follows: Floor and roof assemblies and individual beams in buildings shall be considered restrained when the surrounding or supporting structure is capable of resisting the thermal expansion throughout the range of anticipated elevated temperatures. Construction not complying . . . is assumed to be free to rotate and expand and shall be considered as unrestrained.

"Restraint may be provided by the lateral stiffness of supports for floor and roof assemblies and intermediate beams forming part of the assembly. In order to develop restraint, connections must adequately transfer thermal thrusts to such supports. The rigidity of adjoining panels or structures shall be considered in assessing the capabilities of a structure to resist thermal expansion."

Because it is difficult to determine whether an existing building's structural system is capable of providing the required restraint, the lower hourly ratings of a similar but unrestrained assembly have been recommended.

6. Hourly rating based upon Table 4.2.1, Item B-12-RC-2.

TABLE 4.2.1
REINFORCED CONCRETE BEAMS—UNPROTECTED DEPTH
10″ TO LESS THAN 12″

ITEM CODE	DEPTH	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE- BMS-92	BMS-92	POST-BMS-92		
B-SU-1	10″	10″ × $4^1/_2$″ × 25 lbs "I" beam.	10 tons	39 min			7	1	$^1/_3$

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Concentrated at mid-span.

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TABLE 4.2.2
STEEL BEAMS—CONCRETE PROTECTION DEPTH
10″ TO LESS THAN 12″

ITEM CODE	DEPTH	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE- BMS-92	BMS-92	POST- BMS-92		
B-SC-1	10″	10″ × 8″ rectangle; aggregate concrete (4170 psi) with 1″ top cover and 2″ bottom cover; No. 13 SWG iron wire loosely wrapped at approximately 6″ pitch about 7″ × 4″ × 16 lbs “I” beam.	3.9 tons	3 hrs 46 min			7	1–3	$3^3/_4$
B-SC-2	10″	10″ × 8″ rectangle; aggregate concrete (3630 psi) with 1″ top cover and 2″ bottom cover; No. 13 SWG iron wire loosely wrapped at approximately 6″ pitch about 7″ × 4″ × 16 lbs “I” beam.	5.5 tons	5 hrs 26 min			7	1, 4–7	$3^3/_4$

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Load concentrated at mid-span.
2. Specimen 10-foot 3-inch clear span simply supported.
3. Passed Grade “C” fire resistance (British), including hose stream and reload.
4. Specimen 11-foot clear span—restrained.
5. Passed Grade “B” fire resistance (British), including hose stream and reload.
6. See Table 4.1.3, Note 5.
7. Hourly rating based upon B-SC-1.

SECTION V—DOORS

FIGURE 5.1
RESISTANCE OF DOORS TO FIRE EXPOSURE

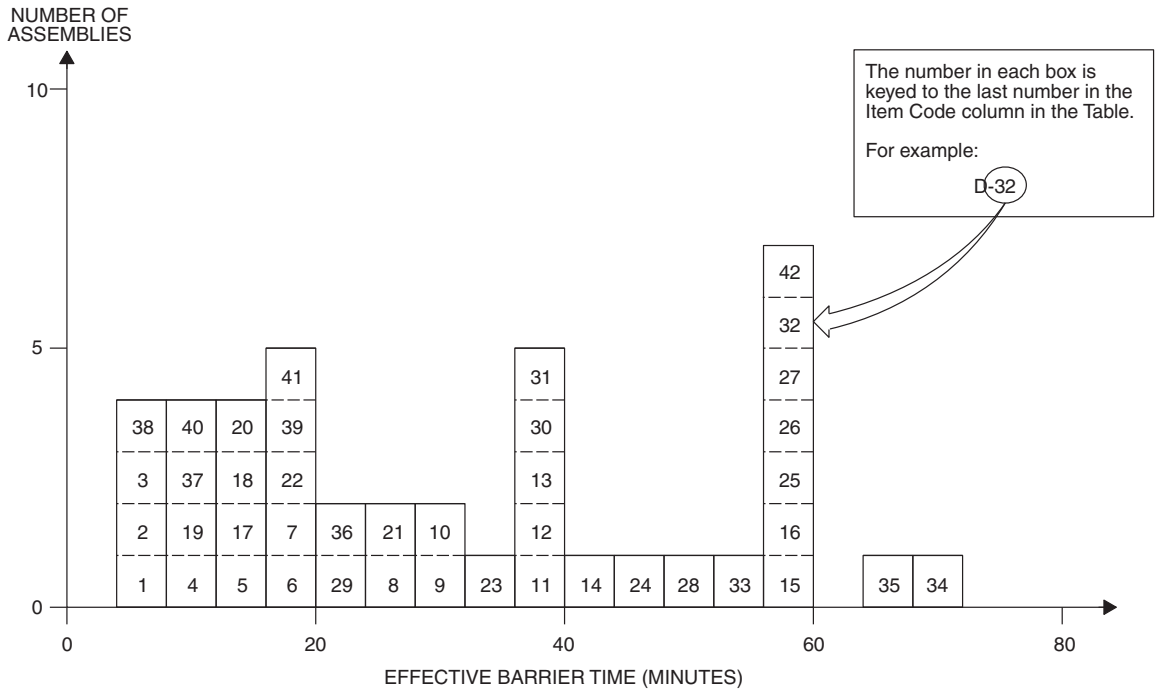

TABLE 5.1
RESISTANCE OF DOORS TO FIRE EXPOSURE

ITEM CODE	DOOR MINIMUM THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. (min)
			EFFECTIVE BARRIER	EDGE FLAMING	PRE- BMS-92	BMS-92	POST- BMS-92		
D-1	$^3/_8$″	Panel door; pine perimeter ($1^3/_8$″); painted (enamel).	5 min 10 sec.	N/A			90	1, 2	5
D-2	$^3/_8$″	As above, with two coats UL-listed intumescent coating.	5 min 30 sec.	5 min			90	1, 2, 7	5
D-3	$^3/_8$″	As D-1, with standard primer and flat interior paint.	5 min 55 sec.	N/A			90	1, 3, 4	5
D-4	$2^5/_8$″	As D-1, with panels covered each side with $^1/_2$″ plywood; edge grouted with sawdust-filled plaster; door faced with $^1/_8$″ hardboard each side; paint see Note 5.	11 min 15 sec.	3 min 45 sec.			90	1, 2, 5, 7	10
D-5	$^3/_8$″	As D-1, except surface protected with glass-fiber-reinforced intumescent fire-retardant coating.	16 min	N/A			90	1, 3, 4, 7	15
D-6	$1^5/_8$″	Door detail as per D-4, except with $^1/_8$″ cement asbestos board facings with aluminum foil; door edges protected by sheet metal.	17 min	10 min 5 sec.			90	1, 3, 4	10
D-7	$1^5/_8$″	Door detail with $^1/_8$″ hardboard cover each side as facings; glass-fiber-reinforced intumescent coating applied.	20 min	N/A			90	1, 3, 4, 7	20
D-8	$1^5/_8$″	Door detail as per D-4; paint was glass-reinforced epoxy intumescent.	26 min	24 min 45 sec.			90	1, 3, 4, 6, 7	25

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TABLE 5.1—continued
RESISTANCE OF DOORS TO FIRE EXPOSURE

ITEM CODE	DOOR MINIMUM THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. (min)
			EFFECTIVE BARRIER	EDGE FLAMING	PRE- BMS-92	BMS-92	POST- BMS-92		
D-9	$1^{5}/_{8}$″	Door detail as per D-4 with facings of $^{1}/_{8}$″ cement asbestos board.	29 min	3 min 15 sec.			90	1, 2	5
D-10	$1^{5}/_{8}$″	As per D-9.	31 min 30 sec.	7 min 20 sec.			90	1, 3, 4	6
D-11	$1^{5}/_{8}$″	As per D-7; painted with epoxy intumescent coating including glass-fiber roving.	36 min 25 sec.	N/A			90	1, 3, 4	35
D-12	$1^{5}/_{8}$″	As per D-4 with intumescent fire-retardant paint.	37 min 30 sec.	24 min 40 sec.			90	1, 3, 4	30
D-13	$1^{1}/_{2}$″ (nom.)	As per D-4, except with 24 gage galvanized sheet metal facings.	39 min	39 min			90	1, 3, 4	39
D-14	$1^{5}/_{8}$″	As per D-9.	41 min 30 sec.	17 min 20 sec.			90	1, 3, 4, 6	20
D-15	—	Class C steel fire door.	60 min	58 min			90	7, 8	60
D-16	—	Class B steel fire door.	60 min	57 min			90	7, 8	60
D-17	$1^{3}/_{4}$″	Solid core flush door; core staves laminated to facings but not each other; birch plywood facings $^{1}/_{2}$″ rebate in door frame for door; $^{3}/_{32}$″ clearance between door and wood frame.	15 min	13 min			37	11	13
D-18	$1^{3}/_{4}$″	As per D-17.	14 min	13 min			37	11	13
D-19	$1^{3}/_{4}$″	Door same as D-17, except with 16 gage steel; $^{3}/_{32}$″ door frame clearance.	12 min	—			37	9, 11	10
D-20	$1^{3}/_{4}$″	As per D-19.	16 min	—			37	10, 11	10
D-21	$1^{3}/_{4}$″	Door as per D-17; intumescent paint applied to top and side edges.	26 min	—			37	11	25
D-22	$1^{3}/_{4}$″	Door as per D-17, except with $^{1}/_{2}$″ × $^{1}/_{8}$″ steel strip set into edges of door at top and side-facing stops; matching strip on stop.	18 min	6 min			37	11	18
D-23	$1^{3}/_{4}$″	Solid oak door.	36 min	22 min			15	13	25
D-24	$1^{7}/_{8}$″	Solid oak door.	45 min	35 min			15	13	35
D-25	$1^{7}/_{8}$″	Solid teak door.	58 min	34 min			15	13	35
D-26	$1^{7}/_{8}$″	Solid (pitch) pine door.	57 min	36 min			15	13	35
D-27	$1^{7}/_{8}$″	Solid deal (pine) door.	57 min	30 min			15	13	30
D-28	$1^{7}/_{8}$″	Solid mahogany door.	49 min	40 min			15	13	45
D-29	$1^{7}/_{8}$″	Solid poplar door.	24 min	3 min			15	13, 14	5
D-30	$1^{7}/_{8}$″	Solid oak door.	40 min	33 min			15	13	35
D-31	$1^{7}/_{8}$″	Solid walnut door.	40 min	15 min			15	13	20
D-32	$2^{5}/_{8}$″	Solid Quebec pine door.	60 min	60 min			15	13	60
D-33	$2^{5}/_{8}$″	Solid pine door.	55 min	39 min			15	13	40
D-34	$2^{5}/_{8}$″	Solid oak door.	69 min	60 min			15	13	60
D-35	$2^{5}/_{8}$″	Solid teak door.	65 min	17 min			15	13	60
D-36	$1^{1}/_{2}$″	Solid softwood door.	23 min	$8^{1}/_{2}$ min			15	13	10
D-37	$^{3}/_{4}$″	Panel door.	8 min	$7^{1}/_{2}$ min			15	13	5
D-38	$^{5}/_{16}$″	Panel door.	5 min	5 min			15	13	5
D-39	$^{3}/_{4}$″	Panel door, fire retardant treated.	$17^{1}/_{2}$ min	13 min			15	13	8
D-40	$^{3}/_{4}$″	Panel door, fire retardant treated.	$8^{1}/_{2}$ min	$8^{1}/_{2}$ min			15	13	8
D-41	$^{3}/_{4}$″	Panel door, fire retardant treated.	$16^{3}/_{4}$ min	$11^{1}/_{2}$ min			15	13	8

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TABLE 5.1—continued
RESISTANCE OF DOORS TO FIRE EXPOSURE

ITEM CODE	DOOR MINIMUM THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. (min)
			EFFECTIVE BARRIER	EDGE FLAMING	PRE- BMS-92	BMS-92	POST- BMS-92		
D-42	$1^{5}/_{8}$″	Wood frame single-lite door with side lites and transom; includes proprietary fire-resistance glazing.	66 min				167		66

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm.

Notes:

1. All door frames were of standard lumber construction.
2. Wood door stop protected by asbestos millboard.
3. Wood door stop protected by sheet metal.
4. Door frame protected by sheet metal and weather strip.
5. Surface painted with intumescent coating.
6. Door edge sheet metal protected.
7. Door edge intumescent paint protected.
8. Formal steel frame and door stop.
9. Door opened into furnace at 12 feet.
10. Similar door opened into furnace at 12 feet.
11. The doors reported in these tests represent the type contemporaries used as 20-minute solid-core wood doors. The test results demonstrate the necessity of having wall-anchored metal frames with the minimum clearance possible between door, frame and stops. They also indicate the utility of long throw latches and the possible use of intumescent paints to seal doors to frames in event of a fire.
12. Minimum working clearance and good latch closure are absolute necessities for effective containment for all such working door assemblies.
13. Based on British tests.
14. Failure at door-frame interface.

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